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# AVIATION AND AIRCRAFT JOURNAL

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VOLUME X
Number 12

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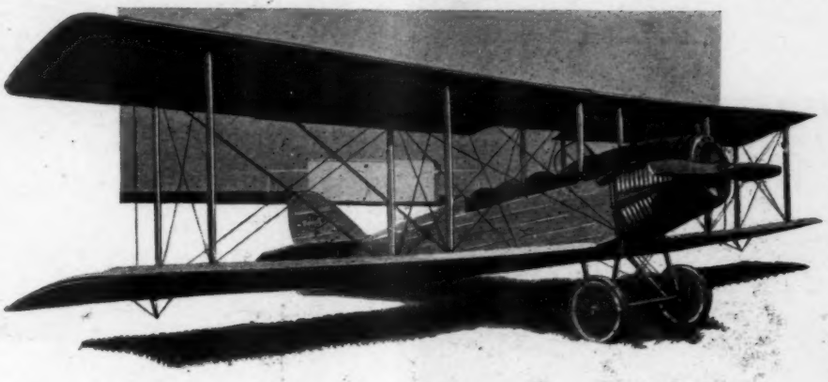

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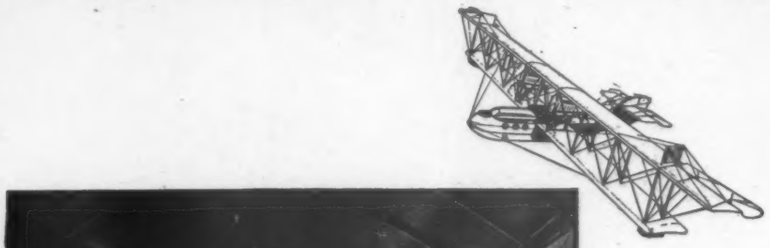

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MARCH 21, 1921 VOL. X. NO. 12

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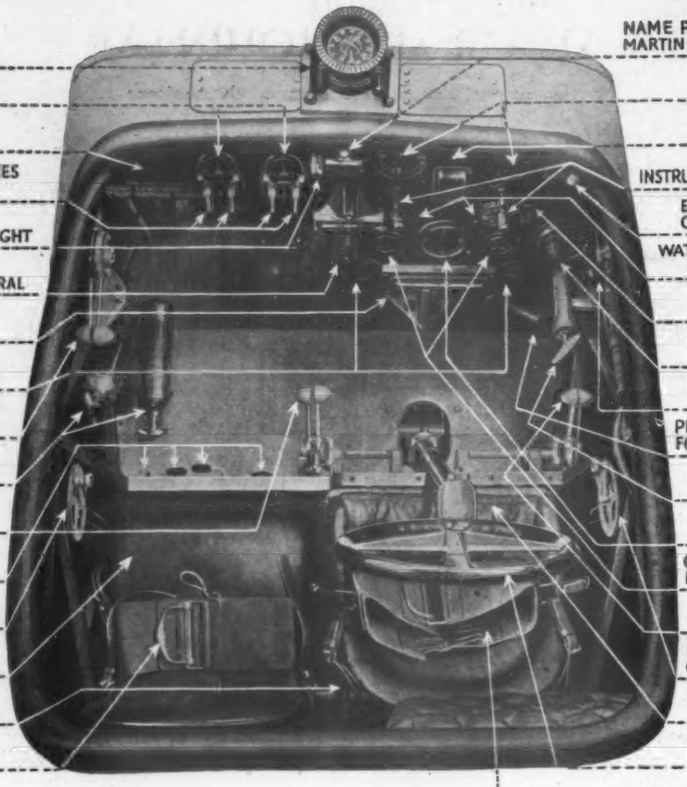
# In the Pilot's Cockpit


1 COMPASS
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15 STABILIZER CONTROL
16 OBSERVERS SAFETY BELT
17 NAME PLATE GIVING MARTIN SERIAL NO. & TYPE
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# AVIATION
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Vol. X MARCH 21, 1921 No. 12


## Air Legislation that Failed

IT is to be greatly regretted that practically all the legislation affecting the government's air activities failed to pass the last Congress. Both the Army and Navy Bills were left unenacted so that they cannot be passed before April or May. Permission was withheld again for the United States to participate in the work of the International Aircraft Standards Commission. Senator New's bill for the creation of a department of aeronautics was not brought up for action. The Bureau of Aviation for the navy slumbered peacefully in committee. Even the bill of Congressman Hicks to commission A. C. Read, J. H. Towers as Commanders, and P. H. L. Bellinger as Lieutenant Commander permanently did not come to anything. It is to be hoped that with a unified Administration aircraft legislation will fare better in the future.

## The Air Force Personnel Problem

NOW that the Air Service has been recognized as a combatant arm and the Navy seems about to establish a separate bureau of aviation, the problem of air personnel deserves immediate consideration. In the event of war, the first line of defense, is the air. There can be, then no delay in mobilization. We cannot count on allies holding the line, while we begin to prepare. The air force must be ready to move out without delay; nor can this be done, unless the personnel be adequate in numbers and efficiency on "D" day. One vital factor must be taken into account in the consideration of this problem: the United States is traditionally unwilling to maintain, as a part of the permanent peace establishment, the requisite force. Whether such a permanent force is desirable, is a purely academic question. The problem can be solved then, in but one way: we must train and maintain an *adequate reserve*, unless we wish to see our country overwhelmed from the air in the next war. This cannot be done unless a *nucleus* for the reserve squadrons be kept always on duty: they must, in short, belong to the regular army. Moreover the training of reserve air officers cannot be done in the somewhat desultory way the army prescribes for the training of reserve officers of other arms: the price in blood would come too high. They must be sent through the army schools—a course of 7 months—then periodically receive refresher training with their squadron nucleus, if they are to become and remain efficient.

This, however, would merely fill the need for the lower grades. As time goes on, the number of planes cooperating in battle rises higher and higher. It takes no seer to predict that the next war will see masses of planes directed from the "flag-plane" of the air admiral. The standard of training of our field and general officers must preserve the quickness of judgment and physical fitness so essential in air fighting. This, however, is largely the work of the regular army and navy. All of a man's time is too little to give to it.

Congress must see to it that the framework—the cadre—is always ready; and that it contains all the elements necessary to an air force, save those lower grades who may be kept well trained with less time and effort, and may therefore be called in from the reserve.

## Limits of Thermal Efficiency

A RECENT series of tests by H. R. Ricardo indicates that taking into account losses due to change in specific heat at high temperatures and to disassociation that the observed results for the efficiency of an internal combustion engine are negligibly different from the ideal results possible. The scope for improvement in the efficiency of an internal combustion engine would seem very narrow. Ricardo indicates a number of lines of attack from which much may be hoped, however. By the use of dopes, such as benzol, toluene and alcohol, compression ratio could be safely carried without risk of detonation to much higher value than at present used. Addition of exhaust gas to the charge might effect a similar purpose.

Another line of attack would be stratification to ensure complete combustion. Ricardo suggests that the two portions of charge might be allowed to mix only after ignition. Stratification should open up the possibility of obtaining higher efficiencies by more complete combustion and should reduce the temperature of the cycle. Some possibilities are also outlined in working with a short compression and long expansion stroke. These and other suggestive ideas are well worth studying in the original paper read before the Royal Aeronautical Society.

## Aerial Diplomacy

IN the new play "The Green Goddess" a situation arises which will bring forcibly to the attention of those who see it the advantages of aircraft over other arms in certain situations where slower means of negotiations would have been too late.

A British officer and his party have made a forced landing in a primitive part of the northern Himalayas and were about to be put to death by fanatical natives. By the aid of wireless they communicated with a flying field in India and the climax of the play is reached when the rescueing squadron of airplanes arrives in time to prevent the execution. A bomb was dropped to awe the assembled people and the single officer who made a landing accomplished his mission.

While this ingenious use of airplanes has only been tried on the stage in Willam Archer's delightful play, it will undoubtedly have many repetitions in history. The numerous instances where warships have accomplished similar errands during the last century are precursors of the aerial diplomacy of the twentieth century.

# Colonel Bane on Aircraft Development *

Briefly stated the recent progress of the Engineering Division of the Air Service in heavier-than-air equipment includes the development of fifteen types of airplanes embracing those for pursuit attack, observation, bombing and training, at present believed necessary to fill Air Service requirements. When we consider that a military airplane carries from one

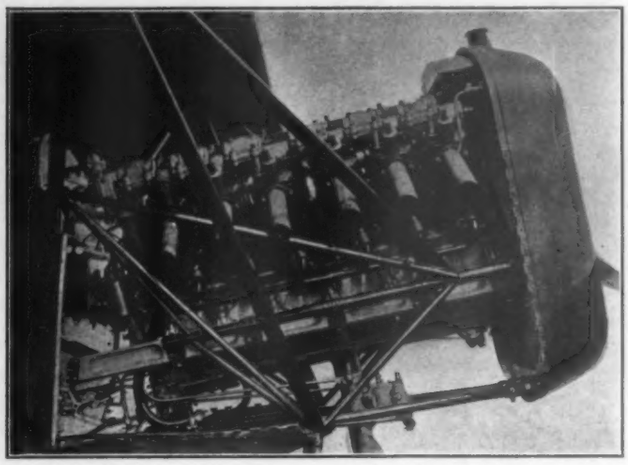

FIG. 1. PACKARD ENGINE MOUNTED IN A FOKKER D.VII PURSUIT AIRPLANE

to twenty thousand pounds of crew with oxygen, parachutes, other conveniences or necessities, fuel and oil, machine guns, cannon, ammunition, sights and instruments of various kinds, bombs, photographic and radio equipment, a total distance of 300 miles to 1000 miles or more, and at a speed of from 100 to 190 m.p.h., and that the engine, all armament and equipment must operate or be operated satisfactorily at air temperatures varying from 100 deg. F. to 50 deg. below zero, and in all weather conditions the diversity of the problems encountered will be appreciated.

It is usually most convenient in a discussion to consider the complete airplane under the heading of the airplane proper, the power plant, the armament and the equipment, and I will follow this plan.

The airplane proper is perhaps the least of our troubles. We are able to build them strong enough, and thanks largely to the engines available we are rarely obliged to discard an experimental airplane because of poor performance. This of course does not mean that performances can not be considerably improved. However the installation of all that goes into an airplane is rarely accomplished to our complete satisfaction. It is a very difficult job and a great deal remains to be done in making satisfactory installations of engines, armament and equipment. Fokker D VII with the Packard engine illustrates an engine installation that provides sufficient strength

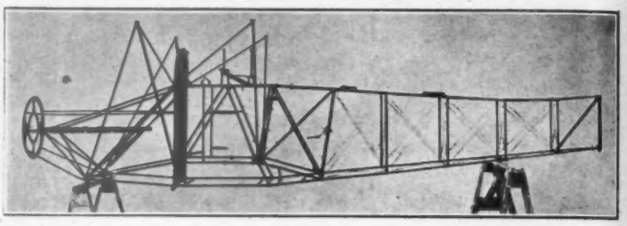

FIG. 2. TUBULAR CONSTRUCTION OF THE CURTISS N.P.1 AIRPLANE

and rigidity, and at the same time the engine is accessible, which means much to those responsible for keeping airplanes in commission. It shows that a neat installation is not incompatible with simplicity. The Verville Packard Racer shows a leaning toward the other extreme. This is not a strictly fair comparison since this airplane was not originally designed for the engine.

Going to one or two of the types at present considered to fill Air Service requirements, we have the Thomas Morse MB-3, a single seater pursuit with the 300 hp. Wright engine. Some of these airplanes will soon be in service on the Border. The G. L. Martin Co. NB-2 is a short distance night bomber with two Liberty-12's. This airplane is a development of the Martin Bomber originally delivered to the Air Service in 1918. The Verville Messenger was built by the Lawrence Sperry Aircraft Co. in accordance with design furnished by the Engineering Division. The original idea was an airplane for messenger work, but it is possible that it may be of use for training.

FIG. 3. CURTISS N.P.1 NIGHT PURSUIT AIRPLANE WITH LIBERTY-6 ENGINE AND THICK SECTION CANTILEVER WINGS

For night pursuit we have a recent acquisition in the Curtiss Co.'s NP-1 with the Liberty-6 engine. This airplane is still

*Lecture given at S.A.E. Winter Meeting.

experimental, having just completed its static test. The construction of the fuselage is of steel tubing.

### *New Engines*

Our first task in engine development has been to develop existing engines, especially the Liberty 12 and Wright 180 and 300 hp. The Liberty engine has been fitted with inverted carburetors which have improved the operation and at the same time they are much more accessible for adjustment. The altitude control has been improved and made effective at higher altitudes. The Wright 300 hp. has been fitted with inclined magneto brackets making a simpler engine bed possible, and eliminating the necessity for R and L hand magnetos.

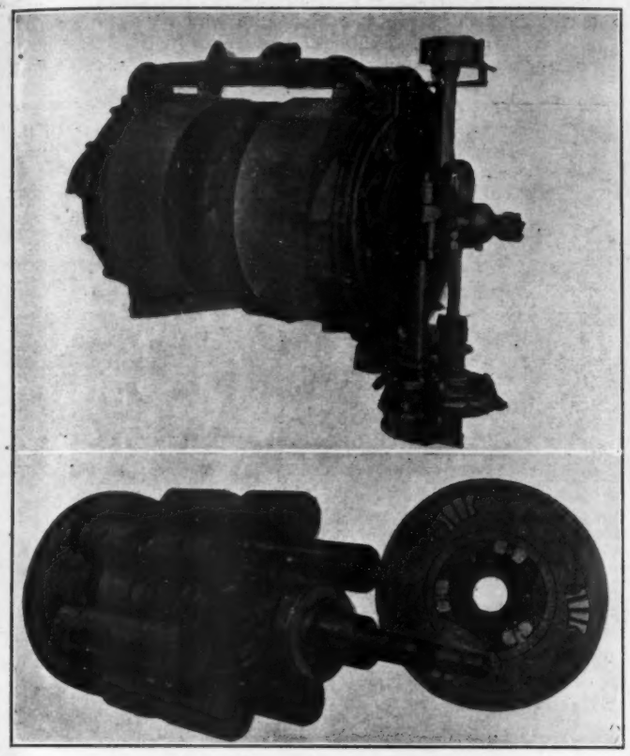

FIG. 4. THE ALMEN BARREL TYPE ENGINE

A great many engine tests have been conducted with a view to improving engine performance. With anti-knock fuel and high compression pistons, consumptions lower than .45 lb. hr., in one case .42 lb. have been observed. This places aviation engines on a footing with the best Diesel engines as regards fuel consumption per delivered horse power hour. A large number of single cylinder tests have been made of air and water cooled engines under construction or being considered for production. One test of a 5½ x 6½ water cooled cylinder with four plugs showed an increase in power, but the gain in using more than two plugs is probably not worth the added complication.

The General Electric supercharger for the Liberty engine, with the variable pitch propeller is being given flight tests.

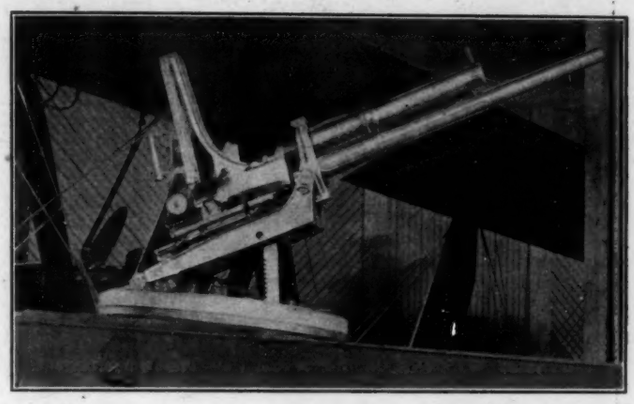

FIG. 5. 37 MM. CANNON MOUNTED ON A MARTIN BOMBER

Steps have been taken to develop a supercharger for the Wright 300 hp. model. We also propose letting a contract for a gear driven supercharger.

Our work in the development of new types has been largely concentrated on large water cooled engines, and air cooled radials from 60 to 350 hp. The 700 hp. Model "W" engine designed by the Engineering Division is now starting its first runs. A reduction gear for the engine has been designed and will be constructed.

The preliminary design of a 1000 hp. 18 cyl. engine is completed and work is progressing on the complete design. The Packard series, and 8 cyl. for training, a small "12" for pursuit airplanes, and a large "12" for bombardment types have completed their tests. The large "12" is the engine installed in the Verville Packard Racer. Additional small orders have been placed for these engines with modifications. It is proposed to somewhat increase the size and horse power of the small "12". The Wright cannon engine is being modified as

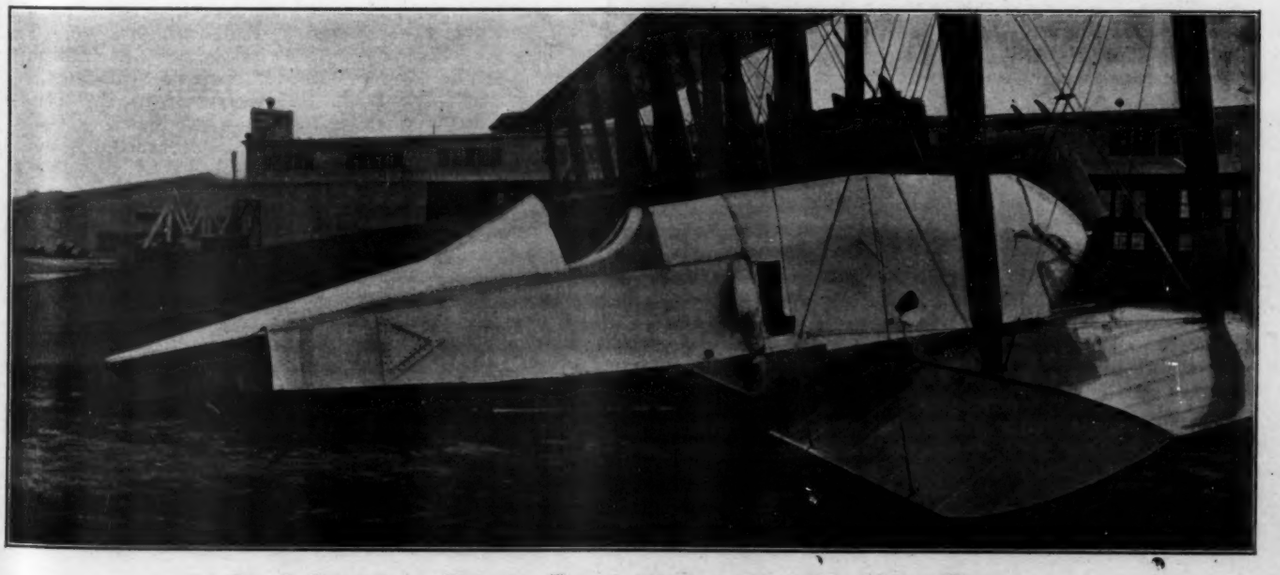

FIG. 6. DETACHABLE FUSELAGE EXPERIMENTED WITH FROM A MARTIN BOMBER

a result of its tests and we hope soon to have a satisfactory engine for the 37 mm. cannon.

The radial air cooled types are being covered by the Lawrance 140-160 hp. for training airplanes, and the 350 hp. Weinberg and Wright engines for service types. The Wright engine has started running, the Weinberg is being prepared for its preliminary tests and we hope to have the Lawrance soon.

For radial water cooled engine we have under consideration one of the barrel type known as the Almen engine. This engine will permit a cannon to be fired through the crankshaft, and in addition an engine of this type of 350 hp. would have a diameter of about 18 in. and a length of about 36 in. This feature of compactness is of course a great advantage. While the general idea is not new, it is believed the present model offers a chance of success, and advantages justify the expenditure of some time and money.

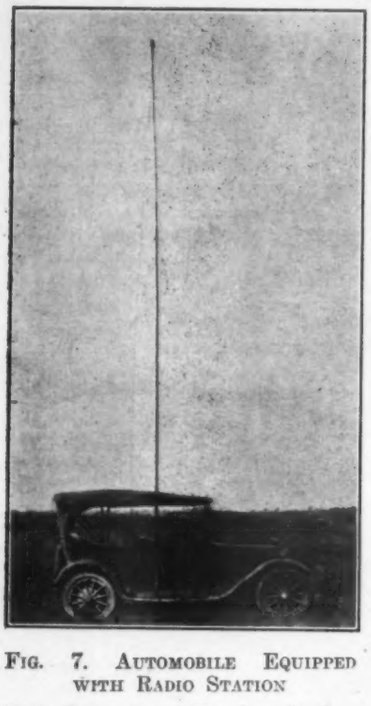

FIG. 7. AUTOMOBILE EQUIPPED WITH RADIO STATION

### *Armament Development*

Passing to armament development, the main problems are satisfactorily to mount the fixed and flexible machine guns and cannon of varying calibres so as to provide for satisfactory feeding of ammunition and ejection of empty shells, for fixed guns to provide for their synchronization, and to provide for carrying bombs. When possible, we endeavor to provide for interchangeability of the various types of machine guns. It should be explained that the Ordnance Department of the Army manufactures the machine guns, cannon and bombs used by the Air Service.

The location of fixed guns has been confined to rather narrow limits because they are synchronized by a device driven by the engine, usually by mechanical means. With the development of the electrical synchronizer the problem will be greatly simplified, since wires are more easily located than tubes rods or cables.

In mounting flexible guns three of the requisites are field of fire, ease in operation, and rapidity of fire. The field of fire is somewhat dependent on the design of the airplane, but a new mount has been developed which increases the field of fire, and is reasonably easy to operate. To assist the observer or gunner in handling the guns, a wind compensator for the flexible mount has been designed and constructed. The force required to move two guns as well as oneself against a wind blast of 125-150 m.p.h. would ordinarily be underestimated, and the compensator by means of springs is designated to assist the operator.

For securing volume of fire a mount to carry four Lewis guns has been constructed. To take advantage of the rapidity of fire of the Browning it has been mounted flexibly. Mounting the Browning flexibly has necessitated designing a reel for the ammunition similar in purpose to the Lewis gun magazine with which you are all familiar.

The 37 mm. cannon has been mounted in almost every conceivable position in the airplane where it would be of any use. It has been mounted flexibly on the Martin Bomber. The 2.95 mountain gun has been mounted and fired from the Martin Bomber.

### *Improvements in Equipment*

Equipment development has been confined largely to the development of crash leakproof tanks, parachutes, hangars, take-off mats, and cameras. Some work has been done on navigation instruments and the use of radio for navigation. One instrument deserving mention is the universal gasoline gage which will go in any tank from 10 in. to 50 in., and also permits some choice in location of the dial. Crash proof is a term applied to tanks designed to prevent gasoline spilling all over the engine, with fire resulting, in a crash which often splits the tank. The tanks are of the usual construction except that they are covered with a thin bag of live rubber. Experiments show an advantage. The development of leakproof tanks is being continued but the advances in the armament of airplanes with heavier calibres and more destructive ammunition will apparently require a new and different solution before long.

FIG. 8. HENDRIX LEUBERT CANVAS HANGAR

### *Detachable Parachute Fuselage*

Satisfactory parachutes of the back, seat and lap type have been developed, and some are in use. The back type will probably be used for training while the seat and lap types will be used for service. The latter types are somewhat smaller and better suited for service because they interfere less with the operations of the pilot, observers and others. In an attempt to get the parachute entirely out of the airplane, and yet avoid the disadvantages of the type attached to the airplane, we recently experimented with what is termed the detachable parachute fuselage. The parachute is carried in the rear of the fuselage and in case of accident the pilot pulls a lever disconnecting himself and the rear of the fuselage.

The technical development of radio is under the direction of the Signal Corps of the Army, the Air Service making service tests only. An automobile equipped with radio has been in use with which it is possible to keep in communication with an airplane, while the automobile is running along the road.

The development of hangars is a difficult problem. The effort to make them easy to erect, take down and transport, and yet withstand all weather conditions results in something of a compromise. One recently constructed by the Henrix Leubert Co. is perhaps the largest canvas hangar yet constructed, and will house three Martin Bombers.

To enable airplanes to take off in muddy fields we are developing so called take off mats. Although it might appear a relatively simple matter, it is very difficult to provide 300 or 400 ft. of a satisfactory width to stand up under rough treatment, and yet not require too much in the way of trucks to transport it. At present there are two types, one a rope net with canvas, the other a canvas mat with hickory slats.

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## Aero Units for the National Guard

The authorization of aero units in the National Guard, which was approved by the Secretary of War on Feb. 10, has thus far resulted in only two applications from the various states, for such organization. The state of Tennessee made application for recognition of an aero unit at Nashville, but it was necessary for the Militia Bureau to reply adversely owing to the fact that the state authorities said they could not provide hangars for the airplanes.

# The Aveline Automatic Airplane Control *

While it must be admitted that the number of aviation accidents directly due to failure on the part of the pilot is extremely small, it is none the less desirable that any means provided to lessen the possibility of such failures should be considered on its merits. A short airplane flight, caried out in normal circumstances, is not a particularly fatiguing operation as far as the pilot is concerned, but a prolonged journey in gusty or misty weather subjects him to a degree of mental and physical strain which it is certainly desirable to avoid by mechanical appliances if possible. We have recently had an opportunity of examining a device, the invention of M. Georges Aveline, which has been fitted to a Handley-Page passenger airplane and is capable of relieving the pilot of the whole work of balancing the machine except during the operations of getting off and landing. The pilot, for practically the whole of the journey, need thus only keep his feet on the rudder bar in order to keep the machine on the correct compass course set, the ailerons and elevator being operated by the apparatus which we propose to describe.

### *Principles of the Mechanism*

Fig. 1 indicates the principle of that part of the apparatus which controls the ailerons, and is mounted transversely in the cockpit or other convenient part of the airplane. The essential part of this device is a disc of red fibre in which a circular channel is formed, the channel being about half filled with mercury. Just above the surfaces of the mercury in the channel an electrical contact is fitted on each side of the disc, and another contact is made with the mercury at the lowest part of the channel; if the machine tilts laterally on either side the circuit between the lowest contact and the contact on that side will thus be completed through the mercury. The upper contacts of the mercury channel are connected to the two coils of a relay and when the circuit is completed through one of the contacts, this relay closes a 12-volt circuit in which are the solenoids controlling the inlet and exhaust valves of a servo-motor worked by compressed air. This servo-motor, as shown in Fig. 1, contains two opposed pistons connected by a rack, and the rack gears with a quadrant connected to the aileron control wires. When air is admitted to one end of the servo-motor and the exhaust valve at the other end is opened, the pistons move, turn the quadrant, and so operate the ailerons to correct the tilt. As shown in Fig. 1, the disc containing the mercury channel is also geared to the quadrant, so that it turns in the opposite direction and, by this means, the contact is broken and the pistons brought to rest after moving a distance corresponding to the amount of tilt. It should also be explained that the rate of movement can be regulated as desired by means of a valve fitted in the exhaust pipes.

An interesting feature of M. Aveline's invention is the means adopted to counteract the effects of centrifugal force, but to understand the effect of this part of the apparatus it is necessary to consider its action during a turn. To turn the machine, the pilot moves the rudder bar with his foot, and the machine immediately commences to swing round in a more or less horizontal plane—say to the right. The resulting centrifugal force causes the mercury to rise in the left-hand arm of the mecury channel making a contact on that side, and the effect of this is to pull down the outer aileron and raise the inner aileron, thus causing the machine to bank in the correct manner. The fibre disc, of course, moves in the opposite direction to the quadrant and would break the electrical connection and leave the ailerons in the positions above described but for the special device we shall refer to in a moment. It must, however, first be explained that, as soon as the correct banking is reached, it is necessary to replace the ailerons into the neutral position, otherwise the banking would become excessive and the machine would probably side slip. To avoid this, the arrangement illustrated diagrammatically in Fig. 2 is employed. A Venturi tube is mounted on each tip of the upper wing of the machine and the throats of the tubes are cross-connected to the arms of the mercury tube as indicated in the diagram. It will be obvious that the suction from the Venturi tube on the outer wing tip will be greater than that from the other tube, since the former is moving faster than the latter, and the effect of this will be to raise the mercury in the inner arm and make an electrical contact on that side. By this means the ailerons are returned to the mid position, and the machine continues to travel on a properly banked turn until the rudder bar is again moved by the pilot, when the reverse action takes place, bringing the machine back on to a horizontal straight-line path.

The apparatus for controlling the elevator is generally similar in principle to that used in connection with the ailerons, the main distinctions being that the plane of the mercury chan-

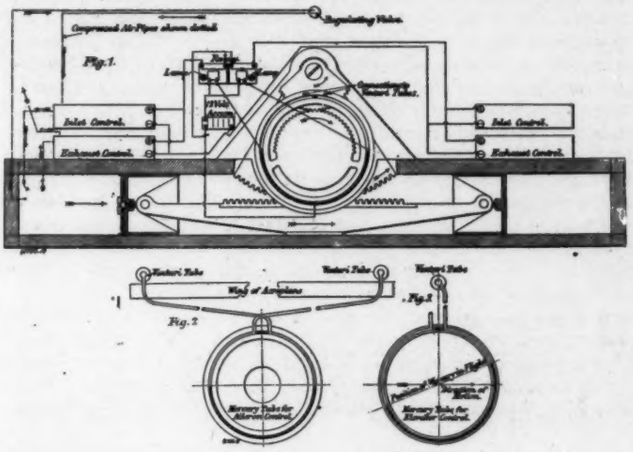

DIAGRAM OF THE AVELINE AUTOMATIC AIRPLANE CONTROL

nel is mounted in a fore and aft direction and that one arm of the mercury tube is connected to a Venturi tube in the centre of the machine, while the other arm is open to the atmosphere. The arrangement of this part of the apparatus is indicated by the diagram, Fig. 3. In normal flight the position of the mercury would be as shown in the illustration, the forward arm being at a higher level than the after arm owing to the suction of the Venturi tube. The pilot has to adjust the fibre disc so that the electrical contacts are just above the level of the surfaces of the mercury in the arms and any alteration in the speed, or fore and aft inclination, of the machine will then complete the circuit to a relay and servo-motor similar to that already described, thus effecting the necessary adjustment of the elevator. It is equally possible for the pilot to set the disc for any desired angle of climb and the machine will then continue to climb at this angle until the disc is readjusted for horizontal flight. In the event of engine failure while the fore and aft automatic control is in use, the drop in speed and the consequent diminution in the suction from the Venturi tube, will allow the mercury to fall in the right-hand arm of Fig. 3 and rise in the left-hand arm. In this way the servo-motor will be operated to put the machine into a downward glide without any action on the part of the pilot, who would only have to steer the machine to a possible landing ground and flatten it out just before alighting.

If it is desired to control the machine in the ordinary way, either or both of the servo-motors can be instantly put out of action by the pilot, without leaving his seat, by means of valves fitted in the compressed-air pipes or by slackening the cables connecting the quadrants with the main control cables. If the former method of disconnection is adopted the apparatus can still be employed as an inclinometer to indicate a tilt in either the longitudinal or lateral directions. This is due to the fact that small incandescent lamps are included in the circuits connecting the mercury channels with the relays. The lamps are fitted in the front of the relay casings, which are mounted on the instrument board in the cockpit in full view of the pilot. When the machine is flying level laterally, or at

*Courtesy, *Engineering* (London).

the correct longitudinal inclination, all the lamps are extinguished, but a slight tilt in either direction, by disturbing the level of the mercury, will cause one or other of the lamps to light up and indicate the existence of the tilt to the pilot.

The compressed air required to operate the servo-motors is provided by two small wind-driven rotary pumps mounted on the bottom longerons on both sides of the fuselage. These pumps maintain a pressure of about 60 lb. per square inch in a cylindrical reservoir placed inside the fuselage. The reservoir also serves as a receptacle for oil for the rotary pumps, these, of course, requiring constant lubrication. A maximum pull of 500 lb. can be produced in the cable attached to the quadrant, this pull being ample for the control of the in use.

The principal objection to the use of apparatus of this kind is, of course, its weight, since the maximum paying load must necessarily be reduced to some extent. The actual weight of the complete installation on the Handley-Page machine above referred to, amounts, we are informed, to 150 lb., which is about equal to the weight of one passenger. This, however, is hardly so serious as appears at first sight, since the passenger-carrying capacity of a large machine is usually limited more by considerations of space than of weight, and, moreover, it is an unfortunate fact that the machines are rarely loaded to their full passenger-carrying capacity. Another point in favour of the apparatus is that its use would probably avoid the necessity for employing an assistant pilot on a long journey with a large machine, and this fact would more than compensate for the weight of the apparatus. It should also be mentioned that, in later designs, the inventor expects to reduce the weight of an apparatus of equal capacity to about 100 lb., and a device designed for use on small two-seater or three-seater machines weighs only 20 lb. In this, however, the use of compressed air is avoided, the servo-motor being replaced by an ingenious friction gear driven by a small windmill. The invention appears to us to be especially useful in flying through clouds, as well as in night flying, and the fact that the Air Ministry, after extensive trials, have had it fitted on twelve Handley-Page bombing machines for the Royal Air Force, indicates that they are satisfied as to its practicability. It has now been taken over commercially by Messrs. Auto Controls, Limited, 19 Regent street, London, S.W., who, we understand are making arrangements to undertake its manufacture themselves.

### No Enlistments in Air Service

The following communication has been received from Maj. Rush B. Lincoln, Chief of the Personnel Division, Army Air Service, under date of Feb. 24:—

1. As a result of recent publicity to the effect that this office was in a position to train about 500 civilians as flying cadets, hundreds of communications have been received requesting application blanks and other data pertaining to this training.

2. The legislation passed by Congress on Feb. 7, 1921, prohibiting further enlistments in the Army until the enlisted strength is reduced to 175,000 has also been construed to stop the further enlistment of flying cadets. This office is now sending replies to these inquiries to the effect that it will not be possible to enlist civilians for this training until the Army is reduced to the above strength. It is estimated that no further enlistments can therefore be made until about the close of this calendar year.

3. In order to offset the publicity given to the enlistment of these civilian applicants for flying training, and in order to reduce the correspondence on this subject at this time, it is recommended that publicity be given to the fact that it will not now be possible to make any further enlistments of civilian candidates for this training until the Army is reduced to a strength of 175,000, and it is estimated that this reduced strength will probably not be reached before the end of the present calendar year.

# French Forge Ahead in Channel Air Service

Handley Page Transport, Ltd., the last British air transport company to maintain a regular mail and passenger air service between London and Paris suspended its service on March 1 owing to a reduction in the French rates.

Prior to this date the fare charged by British and French companies alike was 10 guineas ($55 nominal value) for a one-way trip and 18 guineas for a return trip. On March 1 the two French air lines running between Paris and London, the Messageries Aeriennes and the Grands Express Aeriens, reduced the price of the one-way ticket to 300 francs, or about 5 guineas. They were enabled to do this owing to the increase in subsidy granted them by the French government, which subsidy was conditional upon their reducing the fare to 300 francs and some additional stipulations. As a consequence the last operating British company, which struggled along unassisted by the British government, had to close its hangars.

The situation of British commercial aviation had been a serious one for quite some time. Last summer an advisory committee, which had been appointed to look into the matter, submitted to the British government a report in which state assistance to air transport firms was strongly urged. It was pointed out among others that unless some such help became available before long British commercial aviation seemed threatened by extinction. The truth of this warning became apparent when, in December, 1920, the Air Transport and Travel, Ltd., which was the first company to run a passenger service between London and Paris, suspended its service.

It was only then that the British government departed from its no-subsidy policy and announced that air transport companies operating on approved routes would be subsidized to the extent of 25 per cent of their gross receipts. For this purpose a sum of £60,000 was authorized, but this would become available only at the end of the calendar year, that is, Dec. 31, 1921. That this arrangement proved unsatisfactory to the Handley Page Transport, Ltd., is shown by its suspending the London-Paris service.

The new regulations for the French air transport subsidies differ considerably from the system as it was originally conceived. Previously subsidies were granted under somewhat complicated regulations, the chief factor being distance flown, irrespective of loads carried. The consequence has been that many French machines have flown between London and Paris, and on other routes, carrying no passengers or goods, the flights being made solely with a view to earning the Government subsidy and obtaining a certain amount of advertisement.

The new regulations provide that operating companies, in order to draw the subsidy, must have in service or in reserve a minimum of twenty-eight single engined airplanes or fourteen twin-engined airplanes. The subsidy amounts to 8 francs per kilometer flown for single engined airplanes and to 12 francs for twin-engined airplanes. A construction guarantee of 50 per cent of the cost of new aircraft is furthermore shouldered by the government.

The total French appropriation for commercial aviation for the current fiscal year is 33,000,000 francs (approximately $6,600,000 nominal) and for the coming year a much larger expenditure is contemplated. While a large amount of this money has been devoted to the necessary ground organization, much has been expended in subsidies to operating companies and the policy is beginning to show results. In fact, the latest reduction in the air fares between Paris and London brings the cost of air travel to the level of railroad and steamship travel. Considering the amount of time saved by air travel and the inconvenience avoided at the points of transshipment from train to boat and from boat to train, the French air transport companies seem justified in hoping for a large increase in the number of aerial travelers.

# "Who's Who in American Aeronautics"

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***Beginning with the present issue, AVIATION AND AIRCRAFT JOURNAL will print a concise biography of Americans who through their achievements in the fields of research, design, construction or operation of aircraft in peace and in war deserve to stand out from among their fellow workers in aeronautics. It is fitting that the aeronautical world become cognizant of the accomplishments of these men, for it will assist all in gathering a better understanding of the place American aeronautics holds in the world thanks to the ceaseless efforts of our scientists, engineers and aviators towards greater perfection in air navigation. EDITOR.***

## Orville Wright

Wright, Orville, aeronautical engineer; born, Dayton, Ohio, Aug. 19, 1871; son of Rev. Milton Wright and Susan Catherine (Koerner) Wright. Unmarried.

*Educated*:public schools Dayton, Ohio, Cedar Rapids, Ia., and Richmond, Ind. Honorary degrees: Doctor of Technical Science, 1909, Royal Technical College, Munich; Master of Science, 1909, Earlham College; LL.D., 1910, Oberlin College; D. Sc., 1915, Trinity College; D. Sc., 1917, University of Cincinnati; M. A., 1919, Yale University. Medals: Gold Medal of the Aero Club of France, 1908; Gold Medal of the Aero Club of the United Kingdom (Great Britain), 1908; Gold Medal of the Academy of Sports of France, 1908; Gold Medal, presented by the Aeronautical Society of Great Britain, 1908, Gold Medals from the State of Ohio, 1909, from Congress of the United States, 1909, from the City of Dayton, 1909, from Aero Club of America, 1909; Langley Medal awarded by the Smithsonian Institution, 1910; Cross of "Chevalier of the Legion of Honor" awarded by the French Republic, 1909; Gold Medals awarded by the Institute of France, Academie of Sciences, 1909; Bronze Medal of the International Peace Society; Collier Trophy awarded by the Aero Club of America for the year 1913 in recognition of the development and demonstration of the automatic stabilizer; Elliott Cresson Medal awarded by the Franklin Institute of Philadelphia, 1914; Albert Medal awarded by The Royal Society of Arts, 1917; John Fritz Medal, awarded by a Board appointed by the governing bodies of the four national societies—American Society of Civil Engineers, American Institute of Mining Engineers, American Society of Mechanical Engineers and American Institute of Electrical Enginers, 1920.

*General Business and Professional History*: 1889—1896, printing and publishing; 1892—1903, bicycle manufacturing and repairing; 1905—1907, negotiations for the sale of airplane; five months spent in Europe in 1907; 1908, sold French patents to Compagnie Generale de Navigation Aerienne; 1909, formation of Flugmachine Wright Gesellschaft in Germany and The Wright Company in America; 1909—1912, vice-president, The Wright Company; 1912—1915, President, The Wright Company, Chairman of the Board of Directors of The British Wright Company, organized in 1913; 1915—1920, consulting engineer.

*Aeronautical Activities*: First man to fly in power driven heavier-than-air machine; 1899, with his brother Wilbur experimented with model airplanes using wing warping for the first time for lateral balance; 1900, experimented with man-carrying glider at Kitty Hawk, N. C.; 1901—1902, designed wind tunnel and balances and made measurments of the lift and drift at angles from zero to 45 deg. of several hundred aerofoils. The center of pressure also measured on several of these. The system of control given in the original Wright patents was completed at this time; 1903, built motor-driven airplane with which on December 17, 1903, at Kitty Hawk, N. C., the first flight in history was made; 1904—1905, continued experiments with motor-driven planes near Dayton, Ohio; 1905—1907, developed the four cylinder vertical engine, later used on the Wright Model "B"; 1908, tested machine on contract with the United States Government at Fort Meyer, Va., during which tests the first flight of one hour's duration was made. These flights were terminated by an accident in which Lieutenant Selfridge was killed and Mr. Wright seriously injured; 1909, joined his brother Wilbur in France and Italy. Completed the tests for the American Government in July. Then returned to Europe, flying during several months in Germany; 1910—1915, designing and testing airplanes, automatic stabilizer, etc.; 1915, aeronautic research in wind tunnel at laboratory at Dayton, Ohio; appointed member of the National Advisory Committee for Aeronautics by President Wilson.

*Flying Rating*: Aviation certificate of the Aero Club of America issued under F.I.A. Rules.

*Member*: Engineer's Club (Dayton), The Franklin Institute, Society of Automotive Engineers, Academy of Political and Social Science. Honorary Memberships: Aero Club of Sarthe, France; Aero Club of America; Aeronautical Society of America; Aero Club of the United Kingdom (Great Britain); Osterreichischer Flugtechnischer Verein, Vienna, Der Verein Duetscher Flugtechniker, Berlin; Columbia University Aero Club; Harvard Aeronautical Society; American Society of Mechanical Engineers; Cleveland Aviation Club; Aero Club of Texas; Aero Club of Dayton; Ohio Society of New York.

*Present occupation*: Aeronautical research.

*Address*: 15 North Broadway, Dayton, Ohio; Home, Harmon and Park Aves., Dayton, Ohio.

## Walter Glenn Kilner

Kilner, Walter Glenn, Major, Air Service, U. S. Army; born, Shelby, N. Y., July 8, 1888; son of Charles W. Kilner and Mary Elizabeth (Blocher) Kilner; married Grace Covel, Dec. 4, 1916.

*Educated*: Syracuse public and high schools; U. S. Military Academy, West Point, New York.

*Professional*: U. S. Army Officer.

*Aeronautical Activities*: On continuous flying duty since Nov. 1914; Served with 1st Aero Squadron in Mexico with Mexican Punitive Expedition; Commanding Officer, Mineola, L. I., N. Y.; Ordered to A. E. F., Oct. 1917; Organized and operated 3d A. I. C., Issoudon, France; Chief of all Air Service Training. A. E. F.

*Flying Rating*: J. M. A., 1915; M. A., 1918; Airplane Pilot, 1920.

*War Service*: Army, Commanding officer, Mineola, L. I., N. Y.; Served in Air Service in all commissioned grades to include Colonel.

*War Honors*: Awarded Distinguished Service Medal by United States; Order of St. Michael and St. George (England); Officer of the Legion of Honor (France).

*Books*: "Cantonment Manual."

*Member*: Army and Navy Club (Wash.); Aero Club of America.

*Address*: Air Service, Washington, D. C.; home, Army and Navy Club, Washington, D. C.

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## Leonard H. Drennan

Drennan, Leonard H., Major, U. S. Army; born Taylorsville, Ill. Jan. 4, 1887; Son of John G. Drennan and Margaret (Slater) Drennan; married Mary Fletcher, Jan. 9, 1914.

*Educated*: Chicago Manual Training School, U. S. Military Academy, West Point.

*Aeronautical Activities*: Commanded Ground Officers Training School, Kelly Field; Engineer Officer, Kelly Field; J. M. A. course Rockwell Field, May 1918; Asst. Exec. Dept. Military Aeronautics, 1918; Organized and took overseas Handley Page Training Station No. 1, Oct. 1918; Dept. Air Officer, Chicago, Ill. and Boston, Mass.

*Flying Rating*: Airplane Pilot, J. M. A.

*Member*: Aero Club of America, Aero Club of Mass., Various service clubs.

*Address*: 99 Chauncey Street, Boston, Mass. Home, 31 Homer Street, Newton Centre, Mass.

### Charles Thomas Menoher

Menoher, Charles Thomas, Major General, U. S. Army; born, Johnstown, Penn., March 20, 1862; son of Samuel Menoher and Sarah Jane (Young) Menoher; married Nannie W. Pearson, Oct. 10, 1889.

*Educated*: public schools, Johnstown, U. S. Military Academy, 1886.

*Professional*: Served in the Regular Army in every grade, in order, from 2nd Lieutenant to Major General.

*War Service*: Sailed for France on July 31, 1917, in command of the 5th Field Artillery (Regular); was appointed Brigadier General, National Army, Aug. 5, 1917, and Major General, National Army, Nov. 28, 1917; commanded school of instruction for field artillery at Saumur, France, Sept. 5 to Dec. 14, 1917; Commanded 42d (Rainbow) Division from Dec. 19, 1917, to Nov. 10, 1918; commanded sixth Army Corps from Nov. 10, 1918, until return to the United States, Dec. 17, 1918; while in command of the 42d Division participated in the following engagements: Contact with Enemy in Luneville and Baccarat sectors, Feb. 17 to June 21, 1918; Champagne-Marne offensive in Champagne by the Germans, July 15 to 18; Attack above Chateau-Thierry, from the vicinity of Epiods across the Ourcq to Cherry Chartreuve south of the Vesle, July 24 to Aug. 2; Attack on St. Mihiel salient, Sept. 12 to 14, and in occupation of the sector to October 1, 1918; Attack on Argonne from Oct. 12 to Nov. 8, 1918.

*Aeronautical Activities*: Director of Air Service, Jan. 2, 1919, to July 1, 1920; Chief of Air Service, July 1, 1920, to date.

*War Honors*: Distinguished Service Medal; Victory Medal with five clasps (one for each major operation in which the division was engaged); Croix de Guerre with Palm by French Government; Commander Legion of Honor by French Government; Commander Belgium Legion of Honor (Order of King Leopold).

*Member*: Army and Navy Club (Wash.); American Legion; Veteran of Foreign Wars; Fellow of the American Meteorological Society; all the Aero Clubs and various Service Clubs.

*Present Occupation*: Chief of Army Air Service.

*Address*: Air Service, Washington, D. C.; home, 1820 S Street N. W., Washington, D. C.

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### William Mitchell

Mitchell, William, Brig. Gen., Air Service, U. S. Army; born, Nice, France, Dec. 29, 1879; Son of John Lendrum Mitchell and Harriett (Danforth) Mitchell; married Carolyn Stoddard, Dec. 2, 1903.

*Education*: Private Schools, Milwaukee, Wis.; Racine College; B. A. Columbia University; Distinguished Graduate, Army School of Line, 1908; Graduate Army Staff College, 1909.

*Professional*: Youngest officer in Army in Spanish War; Philippine Insurrection; Army of Cuban Occupation; Army of Cuban Pacification; Mexican Service; World War; General Staff: Feb. 14, 1913, to June 7, 1916; World War Service: April 6, 1917, to Sept. 1, 1917, with airplane division as military observer and aviation officer, American Expeditionary Forces; Chief of Air Service, zone of advance, to Feb. 10, 1918; Chief of Air Service, First Corps, to June 25, 1918; Chief of Air Service, First Brigade Air Service, to July 30, 1918; Chief of Air Service, First Army, to Oct. 18, 1918; Chief of Air Service, group of armies, to Nov. 11, 1918. Returned U. S. 1919. Chief of Training and Operations Air Service 1919-1920; Assistant to Chief of Air Service, 1921.

*Aeronautical Activities*: First American officer under German fire in world war, first American flying officer to cross lines in European War on April 22, 1917; laid the basis for the tactical Air Service in Europe before the coming of the American Expeditionary Forces. Commanded, Air Service of the First Army Corps, the Air Service of the First Army, the Air Service of the Group of Armies and, when the Group of Armies was discontinued, at the time of the Armistice; took the Aviation of the Army of Occupation into Germany, and established it along the Rhine River.

*War Honors*: Awarded Distinguished Service Cross: "For repeated acts of extraordinary heroism in action at Noyon, France, March 26, 1918; near the Marne River, France, during July, 1918; and in the St. Mihiel salient, France, Sept. 12 to 16, 1918. For displaying bravery far beyond that required by his position as Chief of Air Service, First Army, American Expeditionary Forces, setting a personal example to the United States aviation by piloting his airplane over the battle lines since the entry of the United States into the war. Some instances being a flight in a monoplane over the battle of Noyon on March 26, 1918, and the back areas, seeing and reporting upon the action of both air and ground troops, which led to a change in our aviation's tactics, a flight in a monoplane over the bridges which the Germans had laid across the Marne during July, 1918, which led to the first definite reports of the location of these bridges and the subsequent attack upon the German troops by our air forces. Daily reconnaissances over the lines during the battle of St. Mihiel Salient, September 12th to 16th, securing valuable information of the enemy troops in the air and on the ground, which led to the excellent combined action by the allied air services and ground troops particularly in this battle." Distinguished Service Medal; Commander of French Legion of Honor, French War Cross; British Order of St. Michael and St. George.

*Books*: "Our Air Force."

*Member*: Metropolitan (Wash.); Chevy Chase; Aero Club of America; Army and Navy (Wash.); and various other organizations.

*Present Occupation*: Assistant to Chief of Air Service, U. S. Army.

*Address*: Air Service, Washington, D. C.; Home, 1712 Rhode Island Ave.

### James Andrew Mars

Mars, James Andrew, Lt. Col. U. S. Army; born, Galesburg, Illinois, April 10, 1878; son of Hiram Mars and Elizabeth Harrison (Smith) Mars; married Marion Elizabeth Burr, Nov. 3, 1906.

*Educated*: Graduate of grade and high schools, Galesburg, Illinois; A. B., 1899 Knox College; U. S. Military Academy, class of 1903: Graduate of Mounted Service School, Ft. Riley, Kansas, class of 1916; General Staff College, Washington, class of 1921.

*Professional*: Commissioned officer, U. S. Army, since June 1903.

*Aeronautical Acitivites*: On duty with Aviation Section, Signal Corps, Washington, D. C. Dec. 10, 1917 to Jan. 1, 1918; Established and Commanded Aviation General Supply Department, Fairfield (Dayton) Ohio, Jan. 1 to Nov. 12, 1918; In charge of supply for Group 1 Flying Fields, June to Nov. 1918; Assistant to Chief of Supply Group, Military Aeronautics, and officer in charge of Demobilization for Military Aeronautics, Washington, D. C., Nov. 13 to Dec. 15, 1918; Director of Aircraft Production, Dec. 15, 1918 to Oct. 20, 1919; Command of Aviation General Supply Department, Middletown, Pa., Oct. 20, 1919 to Aug. 14, 1920; Student at General Staff College since August 15, 1920.

*War Service*: Philippine Islands, Department of Luzon, 1903 to 1906; Philippine Islands, Department of Mindanao, 1909 to 1912; American Punitive Expedition into Mexico, 1916; World War, 1917 to 1918.

*Member*: Army and Navy Club (Wash).; Army and Navy Club of America (N. Y.); Air Service Association.

*Address*: Adjutant General, U. S. Army, Washington, D. C.; home (temporarily) Washington Barracks, Washington, D. C.

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### Robert Glendinning

Glendinning, Robert, Banker; born, Philadelphia, Pa., Aug. 10, 1867; son of Robert Glendinning and Ellen E. (Butcher) Glendinning; married Elizabeth R. F. Carpenter, Sept. 17, 1894.

*Educated*: Cheltham Military Academy; A. B., 1888, University of Pennsylvania.

*Professional*: Banking business, head of firm, Robert Glendinning & Co.

*Aeronautical Activities*: Balloon pilot, F.A.I. license French brevet No. 301, dated April 28, 1913; Hydroaeroplane pilot, F. A. I. license American certificate No. 28, dated July 14, 1915.

*War Service*: Major and Lt. Col. U. S. Army Air Service from May, 1917, to March, 1919; served St. Michiel front in France Balloons; C. O. Air Service in Italy from Sept., 1918, to Feb., 1919; nineteen months service overseas.

*War Honors*: Decorated officer "Order Crown of Italy".

*Member*: Philadelphia Rittenhouse and Racquet Clubs.

*Address*: 400 Chestnut St., Philadelphia; home, Chestnut Hill, Philadelphia, Pa.

# Ground Engineering *

By Lieut.-Col. H. W. S. Outram

During March and April, 1919, a committee formed under the chairmanship of Sir Frederick Sykes framed the first Air Navigation Regulations and the directions issued thereunder, which became a part of the law of the land on April 30, 1919. In this paper I propose to deal with the sections of the regulations and directions concerning ground engineers.

Schedule 3, paragraphs 5, 7, and 8 of the "Regulations," read as follows:—

(5) All passenger aircraft must be inspected, overhauled and certified as airworthy by competent persons appointed by the owners or users of them, and licensed for the purpose under this schedule, at such times as the Secretary of State may direct, and such certificate or certificates must be produced to the Secretary of State on demand.

(7) No passenger aircraft carrying passengers shall on any day proceed on any journey unless it has previously been inspected at least once on that day by a competent person licensed for the purpose under this schedule, who shall not be the pilot of the particular machine.

(8) If such competent person is satisfied that the aircraft is fit in every way for the flight or flights proposed, he shall sign in duplicate a certificate to that effect, which certificate shall be countersigned by another person in the employment of the owner, giving the time and date of such certification. For this purpose the counter-signature of the pilot may be accepted.

Section IV. of the "Directions" refers to the "competent person" as a ground engineer, and details the procedure for licensing and the form of certificate they are required to render when carrying out their duties.

### *Examination of Ground Engineers*

A candidate, having applied for a license as a ground engineer, is requested to attend an examining board composed of Air Ministry inspectors. The result of this examination guides the Controller-General of Civil Aviation in his decision as to whether the candidate is qualified for a license. It has been suggested that the examination should be in part or wholly written, but the experience gained in the last two years is rather against such a procedure, and in favour of retaining the *viva voce* method. When the various courses in aeronautical engineering that have now been introduced at certain colleges are in operation, their successful completion may possibly be accepted as replacing a part of the present examination. It cannot be too strongly emphasized that any such examination only guarantees to weed out those who are insufficiently qualified. Alone, it cannot prove that all those that "pass" are fully qualified to discharge their important duties. An examining board, having considered a candidate's past experience, questioned him, and formed their joint opinion on his abilities, can do no more than state that in their opinion he is reasonably likely to be an efficient ground engineer. We have had examples of men who have shown brilliance at such examinations, but have developed in practice some little failure in personality which has pervented them carrying their extensive knowledge into effect. It would appear, therefore, that the only way to determine definitely whether a man is a properly qualified ground engineer is to watch him at his work, and in particular to note the results of such work.

Since the publication of the Air Navigation Regulations in April, 1919, and up till Jan. 1, 1921, 664 candidates have been examined; 509 passed and 155 failed. Of the 509 who passed many had applied for a full license, but were finally recommended as qualified only for a license in one category, and even that endorsed to apply to but one or two types, as explained hereunder.

It is seldom that any one man is called upon to cover the whole range of a ground engineer's duties, which would call for knowledge of the construction of aircraft, construction of aero engines, and the operation of both the engine and the aircraft. It has therefore been arranged to issue licenses for a part of these duties, to enable men to carry out that section for which they are suitably qualified.

### *Limited Licenses*

Ground engineers' licenses are divided into four main categories:—

(a) Rigging and daily maintenance of aircraft at the aerodrome.
(b) Overhaul and construction of aircraft.
(c) Top overhaul and daily maintenance of the engine.
(d) Overhaul and construction of aero engines.

It was found that many candidates required licences for duties for which they were qualified, but which formed only a part of any one of these categories. For example, several candidates only require a license to certify the overhaul of one particular type of aero engine of which they had the requisite knowledge and sufficient experience of the construction, though they knew little or nothing about other types. In such cases, therefore, it was arranged to recommend the issue of a still more limited type of license in one category only, endorsed as being restricted to the particular type of engine or aircraft of which the candidate possessed the requisite knowledge.

The examining board report on each candidate's qualifications, and from these reports one fact is most apparent. The majority of candidates may be divided into two classes. One class has a sound knowledge of aerodrome practice, a fair knowledge of ordinary workshop methods, and a surprising ignorance of the qualities of the materials from which an aircraft or aero engine is built, and even less of the many ways in which such materials may be spoilt by bad treatment and ignorance of their peculiar properties. The other class consists of men whose experience has been limited to a large extent to the construction of aircraft or aero engines, and who have gained the knowledge of materials referred to above, are expert in modern aeronautical workshop practice, but have only a very general or theoretical idea of what happens when the aircraft takes the air. Each of these classes is again sub-divided into the metal-worker and the wood-worker. Generally a candidate with good and sound knowledge of metal work has but an elementary knowledge of wood and non-metallic materials, or his knowledge of the latter predominates. Only a few men have shown equally sound knowledge of both branches of aircraft construction.

It has been found that in the majority of cases a candidate can be placed in one of these classes within the first few minutes. The remainder of his examination is spent in ascertaining whether his experience and knowledge in the other divisions are sufficient to warrant a recommendation. It has also been found that the examination of a successful candidate seldom lasted more than half an hour, but on the other hand, it is often necessary to prolong the examination when candidates have failed the convince the examining board of their ability. On occasion the employers of candidates who have failed have challenged the decision, stating that the man failed was in their opinion a better man than another of their employees who had passed. In such cases inquiries have usually shown that the man may have been a better workman, but was insufficiently qualified to inspect the work of others. The ground engineer is in many cases engaged in the first instance as a mechanic, and from his employer's point of view his qualifications as a ground engineer may be subsidiary thereto. Only his qualifications as a ground engineer can be considered when deciding whether he is entitled to a license.

As has already been mentioned, the examination of a

* Paper read before the *Royal Aeronautical Society*.

ground engineer is only completed when his work has been watched. This is one reason why he must be supervised, but the greatest need for supervision is that the knowledge that this exists, and is effective, provides that power behind him necessary to enable him to enforce his decisions. The best ground engineer may be faced with the alternative of issuing a certificate for a doubtful machine or the risk of dismissal and replacement by a less conscientious man. If ever, therefore, an operator suggests that his ground engineer should grant a certificate against his inclination, the latter should be able to reply that he cannot do so, since the supervising inspector would recommend the cancellation of his license, and any certificate would thus become invalid. On the other hand, the simplest way for a ground engineer to carry his responsibilities is to insist upon immediate replacement of each and every part so soon as the first sign of wear becomes apparent. Commercial considerations, however, inevitably tend to postpone that moment and an opposing force is required, obtained by supervision by a disinterested party.

### *Supervision of the Ground Engineer*

In order, therefore, to supervise the work of the ground engineer,the power of reinspection provided in paragraph 6 of Schedule 3 of the Regulations and paragraph 8 of Part IV. of the "Directions" is exercised. It was found at an early date that it was impossible to keep in touch with each individual holder of a ground engineer's license, since a large proportion of those who successfully obtained such licenses did not operate.

It was therefore decided to arrange for periodical reinspection of all aircraft in use, and thereby supervise the work of the active ground engineers. The method adopted is as follows:—

All certified aircraft must fly from licensed airdromes. The Air Ministry have a complete list of such aerodromes, which is kept up to date. Each is visited in turn, and the aircraft examined, the work done by the ground engineers responsible for the daily certificates for each aircraft being checked and noted. The reports thus obtained on each ground engineer are sub-divided and recorded. It has been found that this method gives a useful record of nearly every ground engineer who is operating. Should any escape such supervision, the fact becomes apparent when they apply for renewal of their license, and in such cases particulars of the work done are required, special arrangements being made to judge therefrom as to the man's capabilities. If the evidence of his qualification thus obtained is insufficient he may be called upon (under paragraph 10 of section 4 of the "Directions") to submit to re-examination before his license is renewed.

The first two years' supervision has shown that operators may be divided into two classes: those whose chief aim is to run a regular and reliable service, who have a number of machines in operation, and employ an organized staff of ground engineers; and the owner-operator or small syndicate with one or two machines, whose main object is to obtain the biggest return for their outlay by "joy-flying," exhibition flights, and the like, at sea coast resorts or inland holiday centers. It is appreciated that at this stage the latter class of operator is important from the point of view of the public education in flight. A man who has had one or two short flights during his summer holidays is more likely to consider the possibilities of proceeding abroad by air on business than a man who has never been in the air. It is, however, this latter class of operator that requires the more careful supervision, and it is claimed that the small number of accidents which have occurred have proved that adequate and efficient supervision is possible without undue expense to the State or such a degree of State control as to seriously hamper the operator. It is, of course, essential that the supervising inspector should possess knowledge, ability and experience that will convince the ground engineer concerned that the inspector knows what he is talking about, and equally the inspector must obtain the confidence of the operator (*i.e.* the ground engineer's employer).

### *Duties of a Ground Engineer*

A ground engineer is responsible for maintaining the validity of the certificate of airworthiness, and to do so is required to certify each day on which a flight is made that the aircraft is safe in every way for flight.

The experience during the past two years has been that in some cases there has been a tendency to consider such certificates as merely a piece of formality which must be fulfilled. Certificates have been signed without the ground engineer being in possession of the necessary evidence. When an aircraft has been granted an Air Ministry's certificate of airworthiness, has been used in a normal manner, and is reported satisfactory by the pilot, there has been a tendency to assume that all is well, and to certify accordingly without making that careful examination of the machine and that detailed inquiry into what has happened to it since the last examination, which is essential. The latter point is particularly emphasized. If the ground engineer constantly travelled in the machine he would know exactly what had happened to it, and exactly where to look for possible signs of trouble. He could put his finger on defects which many hours of search would not reveal unless their existence was suspected. Sometimes the ground engineer hands over the machine to the pilot and takes but little, if any, interest in what happens on its journey, although the pilot generally bases his certificate as to fitness for each flight on the ground engineer's daily certificate, and may also rely on the ground engineer to see that the petrol, oil and water in the tanks are sufficient for the proposed journey. The ground engineer is responsible for the airworthiness of the machine until the very moment when it takes the air, and the last few minutes on the ground and the first few in the air often provide evidence which should be carefully noted.

Aircraft, like any other form of transport vehicle, require continuous maintenance, and the ground engineer is responsible that the machine to which the original certificate of airworthiness was granted is unaltered by such maintenance. He must also consider the conditions under which the machine is stored; how these are likely to affect the various parts of which the machine is composed; he must be familiar with the deteriorating effects of different storage conditions on the various units of the machine, and if he knows that these are particularly deleterious to one especial part, must watch that part and detect the first signs of deterioration that call for its replacement. The ground engineer must decide when it is necessary to fit a spare part, whether this be a nut or a complete component. The mere fitting of the new part is but the smallest part of this duty. He must satisfy himself that the part has been correctly made in accordance with the drawings on which the certificate of airworthiness was granted, and is of the material specified in these drawings. It must have been inspected during construction (as laid down in detail in paragraph 21 of Section 3 of the "Directions"), and he must have actual evidence that it has passed such inspection, and further, must satisfy himself that the part has not been damaged or deteriorated since such inspection was carried out. A ground engineer might possibly be excused if he failed to discover a hidden defect that had developed in a machine during flight, but there should be no possible excuse for permitting a new part to be fitted into a machine unless fully satisfied as to its history.

### *Engine Overhauling*

The certificate concerning the fitness of the engines is probably one of the most difficult duties of a ground engineer. Obviously the airworthiness of the aircraft depends very largely upon the engines. No one would dream of certifying that a machine designed to use engines developing 300 hp. each was airworthy if fitted with engines developing, say, 200 hp. each, yet some have tried to use aircraft when the engines have lost power to such an extent that it has been almost impossible for the machine to take off with its full load.

Records taken over a considerable period show that for every eight forced landings due to engine failure, one is actually due to defect in the engine itself, the remainder being directly caused by some default in the installation of the engine. So long as the engine and the aircraft structure are designed as separate units, installation must remain a weak point of the whole machine, so that the ground engineer must give his constant attention to the daily routine of

cleaning petrol filters, checking petrol flows and water connections, etc., ensuring that all ignition leads, switches and contacts are in good order. He should verify each day that the engine runs up to its proper speed, see that the oil pressure builds up and is properly maintained, and that the radiator temperature is normal. He should also make a point of inquiring of the pilot as to any sign of excessive engine vibration in the air, the flexibility of the engine and any unusual circumstances which may have characterized its running during the daily trips. His discretion must be used as to the period of running requiring a top overhaul for cleaning purposes, minor adjustments and replacements and in due time have the engine removed for complete overhaul. No hard and fast rule can be laid down as to the period of running before top overhauls and complete overhauls should be carried out, since there is still a considerable variation in this respect, even in engines of the same design and origin.

The repairing of an engine requires on the part of the ground engineer in charge of it almost a wider and more detailed knowledge than is needed in the building-up of a new engine, in that he must determine the safe limits to which crankshafts, cylinders and the like may be reground, and the extent to which part-worn components may be retained. A sound knowledge of materials and their heat treatment, too, is essential to justify his responsibility in the acceptance of new parts. This all-round knowledge is not easily obtainable under normal conditions of works organization and employment. More often than not a would-be ground engineer is found to have excellent experience in the erection and testing of a particular type of engine, but for materials and heat treatment he has relied entirely, and probably quite justifiably, on another department of his works organization. So long as he has this other department to fall back on in his supervision of the overhaul of the engine, he is safe, but it is eminently desirable that he should endeavor to improve his own knowledge, and so become self-supporting and capable of carrying through his job on his own, and without the resources of a complete works organization, which may not always be at his disposal.

### *Notices to Ground Engineers*

It is here urged that ground engineers and aircraft operators generally should suggest matter for such Notices. Experience with any particular type of aircraft or engine usually brings to light the little troubles to which it is particularly prone. Such experience gained by the larger companies operating a number of machines would be of value to the owner or operator of a single machine of the same type, and in many cases to owners of machines of similar types, and could often be published as "Notices to Ground Engineers" with advantage. Occasionally particular points of weakness only become apparent after more or less prolonged use or as the result of an accident. When such cases come to light the certificates of airworthiness for all machines of the type in question are suspended until such time as the defect has been remedied. Information of such suspensions is issued as a "Notice to Ground Engineers". Once the ground engineer's attention has been drawn to a point of weakness it is sometimes possible to permit the aircraft to fly until temporary or permanent replacement has been made without taking the machine out of service. It is an important duty of the ground engineer to pay particular attention to the terms under which certificates are thus modified, and he must adhere strictly thereto while continuing to grant the daily certificate.

### *Insurance of Aircraft*

The insurance of aircraft is already of such importance as to call for a separate paper, and on this occasion it is only proposed to touch on one aspect, that of the relation of the ground engineer to the insuring company. So far as the Air Navigation Regulations are concerned, the ground engineer is only required to certify that the aircraft is in every way safe for flight. The risk of insuring any aircraft is governed to a large extent by the following points, all of which have to be taken into consideration:—

(*a*) The design and primary standard of construction of the aircraft.

(*b*) The condition of the aircraft when setting out for the flight.

(*c*) The nature of the flight and the proposed load.

(*d*) The skill and experience of the pilot, particularly with regard to the particular journey undertaken.

(*e*) The meteorological conditions at the time of the journey.

Of these factors the second is that which concerns the ground engineer. It may often, therefore, be his duty not only to maintain that minimum standard insisted upon by his supervisors, but a higher standard which may be laid down by his employers, by the reputation for which they may obtain advantageous insurance terms.

It is suggested that it may be found necessary to consider the formation of a superior grade of ground engineer. It is already probable that a large operating company would find it desirable to place their ground engineers under the control of one man who had higher technical qualifications and ability than are required for the ordinary ground engineer. Such a man would go far toward ensuring the reliability of any service and would advance the status of "ground engineering" nearer to that which must be attained if these men are to safeguard adequately the aerial transport of the future.

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## Design of Wind Tunnels and Wind Tunnel Propellers

**N. A. C. A. Report No. 98**

This report is a continuation of National Advisory Committee for Aeronauties' Report No. 73. The variations in velocity and direction of the wind stream were studied by means of a recording air speedmeter and a recording yawmeter. The work was carried on both in a 1-foot diameter model tunnel and in a 5-ft. full-sized tunnel, and wherever possible comparison was made between them. It was found that placing radial vanes directly before the propeller in the exit cone increased the efficiency of the tunnel to a considerable extent and also gave a steadier flow. The placing of a honeycomb at the mouth of the experimental portion was of the greatest aid in straightening the air flow, but at the same time this decreased the efficiency of the tunnel. Several types of diffuser were tried in the return air stream, but only a slight improvement resulted in the steadiness of the flow. Some experiments were tried on the effect of the shape of exit cone and it was found that a straight cone in all cases gave the highest efficiency. The effect of placing a closed room about the model tunnel of the same proportional size as the building on the 5-foot tunnel decreased the speed for the same power 14½ per cent. Several spinners were placed about the propeller in the model tunnel in the hope that they would give increased efficiency and a steadier flow, but in no case was there any improvement.

A copy of Report No. 98 may be obtained upon request from the National Advisory Committee for Aeronautics, Washington, D. C.

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## New Instrument Firm

The Consolidated Instrument Co. of America was formed to render manufacturers, engingeers and designers a complete engineering and sales service in connection with all types of speed indicating and recording instruments and devices. Its staff is made up of engineers who are pioneers in this line, who have had years of research, experimental and manufacturing experience in the production of such instruments and devices, and who are therefore equipped to provide expert advice and a unique service wherever it is desired.

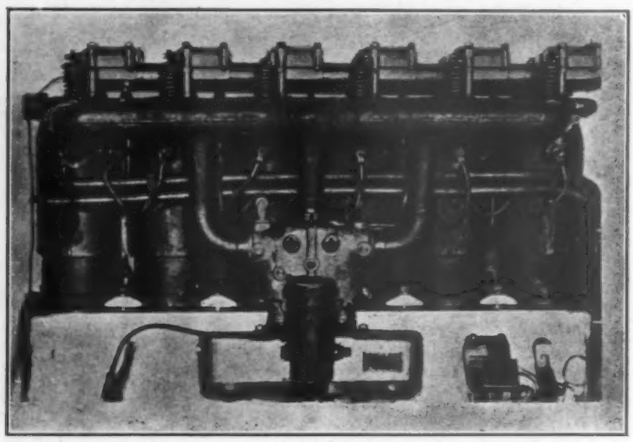
The Consolidated Instrument Co. of America controls exclusively the entire American distribution of the well known Jones Tachometers, and has at its disposal the excellent production and experimental facilities offered by its manufacturer; as well as the complete co-operation of its inventor, Joseph W Jones.

This company also distributes exclusively throughout the United States, the famous Hasler Speed Indicator and Tel Speed Recording Devices, which have an enviable reputation in practically every part of the civilized world.

# The B. M. W. 6 Cyl. 185 Hp. Engine *

The B. M. W. aviation engine resembles very closely the Mercedes 200 hp. engine in all essential features except the pistons, carburetors, and intake manifolds. The weight is about the same, but the bore is 10 mm. larger and the stroke 20 mm. longer than on the Mercedes.

The engine is provided with aluminum alloy pistons with a compression ratio of 6.51:1. On account of the high compression ratio it is impossible to use gasoline at low altitudes without restricting the amount of mixture fed to the cylinders. This restriction, or "choking down," is necessary in order to maintain compression pressures below the self-ignition point of gasoline, and is accomplished on the B. M. W. engine by means of a special carburetor. To compensate, in a measure, for the decrease in atmospheric pressure with altitude, the carburetor is so designed that the restriction can be removed at



SIDE VIEW OF THE B. M. W. 185 HP. ENGINE

high altitudes and thus take advantage of the high compression ratio, and more nearly maintain sea-level power.

*Design of carburetor.*—The design of the carburetor is very unusual, consisting of three separate carburetors incorporated in a water-jacketed aluminum casting. There is one float chamber which feeds the four jets. These four jets consist of an idling jet and one main jet in the center carburetor and one main jet in each outside carburetor.

Two separately controlled systems of butterfly throttle valves are employed, which will be called the "primary" and "auxiliary" throttle systems, respectively. One primary throttle is mounted in the center carburetor directly over the main jet. Each of the outer carburetors cantains two throttles—one primary throttle and one auxiliary throttle. The two auxiliary throttles are mounted above the main jets of the outside carburetors, and both are operated by the same control through a tie rod. The two primary throttles in the outside carburetors are located above and to the side of the auxiliary throttles. These main throttles of the outside carburetors are opened by the same control rod that opens and closes the center main throttle, but due to the slotted operating links, they remain closed until the center throttle has been opened halfway. Each of the outside main throttles is closed by a spring when the main throttle rod is moved to the closed position.

The single float chamber is made of brass and is the usual type for a sump below the float and needle valve. This sump serves to collect any dirt or water which finds its way into the fuel inlet. A wire ganze filter is located just below the needle valve in the sump chamber.

*Action of carburetor.*—When all throttles are closed, the idling jet only is in operation, all the mixture being drawn up through the central induction pipe to the intake header. As the center throttle is opened farther, the center main jet begins to function and supplies all of the mixture, the outer main throttles remaining closed until the main throttle lever has moved through half its travel. Beyond the half-open position the two outer main throttles begin to open, allowing air to be drawn up past the outer main jets, through the semicircular slots out in the auxiliary throttles, thus bringing the outer main jets into action. The mixture from the two outer carburetors passes up through separate induction pipes to the intake header, where it blends with the mixture from the central carburetor. The position for full power at sea level is with the main throttles in all three carburetors wide open, while the two auxiliary throttles are fully closed and are passing only that amount of mixture which will go through the notches cut in their edges.

The auxiliary throttle system constitutes the control for admitting more mixture at altitudes. For altitude running these throttles are opened, permitting more mixture to flow through the main throttles and induction pipes to the intake header. The auxiliary throttles have no mechanical connection with the center carburetor. They merely increase the amount of mixture passing to the intake header as they are opened, consequently increasing the volumetric efficiency of the engine. Whether or not the altitude throttles also lean down the mixture has not yet been determined.

The mixture obtained with the auxiliary throttles closed is supposed to be correct for ground level running with gasoline. However, it was found that for high speeds the power output of the engine was increased by opening the auxiliary throttle slightly when running at ground level. With gasoline as fuel, it was impossible to open this auxiliary throttle more than one-third without causing preignition. When the benzol-gasoline fuel was used, the auxiliary throttle could be opened a little more than halfway at sea level before preignition occured.

*Induction system.*—From each carburetor a separate induction pipe leads to the intake header which serves all six cylinders, as shown in the photograph. The induction pipes are unusually small for an engine of this size, but the diameter of the header itself is about normal. The air for the carburetor passes through a passage under the ribbed surface of the lower half crank case and enters the mixing chambers from below. In passing through this scoop, the air assists in cooling the oil in the crank case and at the same time becomes slightly warm.

DIMENSIONS OF B. M. W. AVIATION ENGINE

| | |
|---|---|
| Number of cylinders | 6. |
| Bore | 150 mm.=5.906 in. |
| Stroke | 180 mm.=7.086 in. |
| Cycle | Four-stroke. |
| Cooling | Water. |
| Rotation of propeller (facing propeller). | Counterclockwise. |
| Piston displacement per cylinder. | 194.08 cu. in. |
| Total piston displacement | 1,164.50 cu. in. |
| Firing order | 1, 5, 3, 6, 2, 4. |
| Method of numbering cylinders | Begin at propeller end in sequence. |
| Clearance volume | 577 cc.=35.18 cu. in. |
| Compression ratio | 6.51 to 1. |
| Stroke-bore ratio | 1.20 to 1. |
| *Carburetor:* | |
| Three main jets | No. 56 drill size (fits loosely). |
| Two outer chokes | 1 1/64 in. diameter. |
| Center choke | 1 1/16 in. diameter. |
| Mixture outlet from carburetors, diameter. | 1.77 in.=45 mm. |
| Intake header at cylinder port, diameter. | 2.24 in.=57 mm. |
| Center main jet is 3/16 in.=(5 mm.) lower than two outer main jets. | |

### *Observations on Test*

Only one failure occured on test, namely, that of the vertical cam-shaft drive shaft, which fractured at its upper bearing just above the bevel driving gear. When this was repaired, no more failures of any kind occured. The engine functioned smoothly except for a slight preignition at low speeds when using gasoline. This was permitted, due to the necessity for getting a maximum sea-level power and because the preignition was not present or noticeable at any but low speeds; that is, 800 or 900 r.p.m.

* Excerpt from *Air Service Information Circular.*

### *Analysis of Results*

This engine is almost an exact copy of the 200 hp. Mercedes engine in all respects except the carburetor and induction system. The increase in bore and stroke has been obtained with a slight decrease in weight. It is therefore of slightly lighter construction than the Mercedes but still maintains the typical rugged design which is a feature of the German aviation engines.

The results of the tests indicate that it is possible to use high-compression pistons with a choked-down carburetor and small manifolds to obtain a very high efficiency from the fuel used in addition to minimizing the decrease of horsepower at high altitudes. This is accomplished, however, at the expense of an appreciable reduction in sea-level power. The specific fuel consumption when using the benzol mixture averages about 10 per cent less than the best average which has been obtained with an engine equipped with the usual type of American manifolds and carburetors. The extra throttle lever which is necessary in this installation takes the place of the usual altitude control valve. It has not been definitely determined whether the mixture ratio is changed by opening the auxiliary throttles. There is apparently no provision for changing the mixture ratio at altitudes above the point where the auxiliary throttles are moved to the open position. Judging from this and from the apparently excellent performance of this engine in flight at high altitudes, it is probable that the carburetors possess a considerable degree of inherent altitude compensation. This, however, has not yet been definitely proved.

## Airplane Report Forms

The Army Service has compiled a most complete and practical airplane report form, consisting of six pages of the standard market size, 8½ x 11 in. punched for the usual three ring binder, which may be obtained at any stationery store. The first page is devoted to a summary of the general characteristics of any airplane. The second page gives detailed description and characteristics of the airplane itself. The next two pages go into the details of the power plant, the tanks and controls. The fifth page carries an analysis of the weights, with remarks on the flying qualities of the craft. The sixth page is the chart for the climb, speed and r.p.m. curves.

These forms were prepared after study of all those prepared or in use in the Air Service, with such suggestions as were apparent from the forms used by allied countries.

It is believed that the standardization of a report form for airplanes will be of great value to the industry. It will definitely enable all airplanes to be described along the same lines and will make simple the comparison of different machines of the same type.

## Cincinnati Geared Head Lathes

The latest Cincinnati Geared Head Lathes, shown herewith are supplied in sizes of 16, 18, 20, 22, 24, 26, and 28 in. either single pulley, belt drive or motor drive.

The Cincinnati Geared Head Lathe shown in Fig. 1 is a general manufacturing equipment fitted with hexagon turret on bed, power feed, silent chain drive. As the speed variations are obtainable in the head, constant speed motors only are required.

Levers at front operate all feed changes. The index plate gives the lever positions for each speed. For instance, to obtain twelve revolutions, the lever position would be 3-B-C. For 305 revolutions 2-A-D. A neutral position is also obtained, permitting the revolve spindle by hand for chucking similar jobs. Spindle is made of high carbon crucible forging. It carries only the face gear and one direct driving gear operated by lever A-B. Intermediate shaft has three sliding gears and three stationary gears of different diameter.

Drive shaft operating at constant speed consists of two sliding gears meshing with gears on intermediate shaft. When the gear to the left on this shaft is in mesh with the gear on intermediate shaft, it gives the first six changes of low speed. When meshing the gear to the right on this same shaft the additional six changes for the higher speeds are secured. Shafts in this head are of high carbon nickel steel. Gears on back gear shaft, also the direct driving gears are made of steel forgings, heat treated. All of the others are of high carbon nickel steel. Bushed throughout with best bronze. Teeth of gears are rounded. Only the gears actually used for driving are in mesh consuming all the power on work produced.

All bearings and gears, including those not in use, are oiled automatically by the splash system. Indicators always show

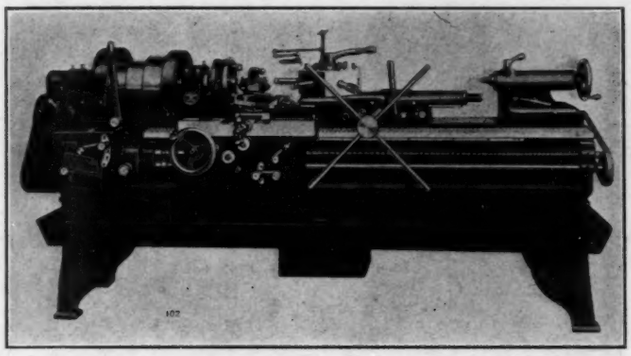


FIG. 1. CINCINNATI GEARED HEAD LATHE

amount of oil in the base of head. Oil is properly distributed by the gears to grooving provided in top cover. The rotating shaft bearings, therefore, are kept oiled.

Fig. 2 shows the Cincinnati Patented Geared Head Lathe for single pulley belt drive, driven direct from a line shaft, therefore, no countershaft is needed or direct connected motor drive. The motors are mounted on headstock or in rear of cabinet leg, driving through bolting, silent chain or gearing. Variations are obtained in the head, therefore, only constant speed motors are required.

Twelve mechanical speed changes in geometrical progression are secured on these lathes and all through sliding gears, by simply shifting three levers. Operators can have no excuse

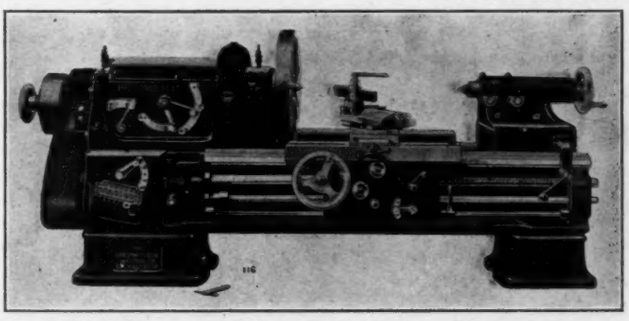


FIG. 2. CINCINNATI GEARED HEAD LATHE FOR SINGLE PULLEY DRIVE

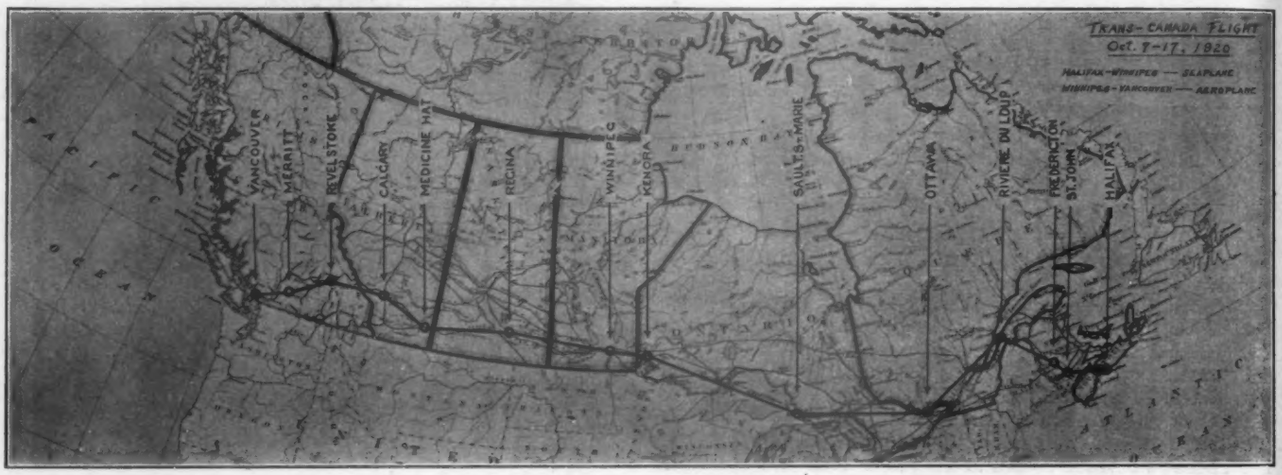
in not using the correct speeds and feeds for the most efficient results. No safety device is necessary, as levers and gearing are so arranged not to permit them to lock while operating. Any lever can be shifted without interfering with the other. Index plates are so simple and easily read that the most inexperienced will have no trouble to obtain any speed or feed desired. At the apex is a control by which the spindle may be stopped, started or reversed without stopping the overhead works or the motor.

The design of these lathes is similar to the equivalent of the Cincinnati Cone Type, but employing a more expensive method of driving the spindle through gearing to get the most output as a manufacturing lathe, rather than for tool room work. Standard equipment is furnished as with the other type, excepting countershaft, which is not needed. Such extra attachments as Taper, Draw-in, Turrets, Chucks, Lathe tools, etc., may be added at any time.

# Canadian Air Progress-1920

With the appointment of Lt. Col. E. W. Stedman, as Director of Technical Services, definite steps are now being taken to organize a strong technical branch to undertake the engineering and scientific work of the Air Board, the need for which has been felt for sometime. It is recognized that without the highest efficiency in this branch, the flying services cannot operate successfully, nor can the control of civil aviation be undertaken with satisfaction to commercial aviation firms, to the industry or to the public generally.

The technical branch will not only be responsible for the operation and maintenance of the main engine repair section, aircraft repair section, and other repair depots, but will advise the Controller of Civil Aviation in all technical matters connected with the certification of airworthiness of machines, and will likewise advise the Inspector General of the Canadian Air Force, and the Director of Flying Operations with regard to technical considerations in connection with improvements in design and modification of machines and equipment.




MAP SHOWING TRANSCONTINENTAL ROUTE FLOWN BY THE CANADIAN AIR FORCE

### *Unification of Medical Services under the Air Board*

It has been decided in the interests of coordination and economy, to effect unification of the medical services under the Air Board, and accordingly in future the senior medical officer, Canadian Air Force, and medical officer employed in the Civil Aviation branch of the Air Board, will be replaced by a "Director of Medical Services," who will combine and carry on the duties hitherto performed separately by the two officers above mentioned.

Dr. William H. Cronyn, formerly the medical officer employed in the Civil Aviation Branch, becomes Director of Medical Services, and is responsible to the Air Board for the administration of the medical services of the Canadian Air Force, as well as for the medical examination of commercial pilots. He will advise the Air Board of all matters pertaining to hygiene, sanitation and medical research.

### *Trans-Canada Flight*

The trans-Canada flight from Halifax to Vancouver was successfully undertaken and completed. Although unfortunate delays occurred which prolonged the progress of the flight considerably, it is realised that this was a pioneer effort in Canada, and an analysis of the causes for the various delays has shown that the difficulties encountered, were those arising rather from a lack of sufficient ground organisation, than from any inherent difficulties in flying as such.

The primary objects in undertaking the flight were to gain knowledge and experience in both the possibilities and limitations of long-distance flying in Canada, to ascertain as definitely as possible the exact nature of the difficulties to be encountered, with their probable remedies, and to secure detailed information as to the suitability of the various sections of the routes selected for transcontinental flying. In these respects the Air Board feels satisfied that the undertaking has proved a success, and may well pave the way for regular transcontinental flying as soon as an adequate ground organisation, with sufficient emergency landing grounds, refuelling stations and wireless communication to machines has been established.

## Flying Operations Branch

### *Review of Activities During* 1920

The director of Flying Operations reports the completion of a successful and encouraging season's operations, notwithstanding the fact that flying did not begin until late in August. The following is a tabulated summary of the extent of flying carried out during the year and the number of accidents and fatalities that have occurred:

| | |
|---|---|
| Number of flights made | 398 |
| Number of hours flown | 480.10 |
| Approximate mileage | 33,612 |
| Number of accidents (Three slight crashes only) | nil. |
| Number of personnel killed | nil. |
| Number of personnel injured | 1 slightly. |

During the winter months the air stations at Roberval, Que.; Haileybury, Ont.; and Ottawa, Ont. are temporarily closed, the personnel and equipment being sent to Camp Borden, Ont., and Halifax, N. S. The station at Morley, Alb. is also closed and will be transferred to High River, Alb.

### *Field Operations*

The following operations for various districts are under consideration:

*Vancouver District.*—Forestry work, surveys, fishery protection and patrol, entomological work and communications.

*Mackenzie River Basin.*—Communication and exploratory work.

*Northern Manitoba.*—Forestry protection and survey and communication.

*Northern Ontario.*—Forestry protection and survey and communications.

Departments to be served.—Interior Department, Mines Department, Indian Affairs, R. C. M. P., Entomological Branch, Conservation Commission and Ontario Government.

*Ottawa District.*—Experimental flying and survey work.

Departments to be served.—General.

*Lake St. John.*—Forestry protection and survey, and exploration.

Departments to be served.—Quebec Government, Agriculture Department, Conservation Commission and R. C. M. P.

*New Brunswick.*—Forestry work.

Departments to be served.—New Brunswick Government, Entomological Branch and Conservation Commission.

## Civil Aviation Branch

### *Certificates and Licenses Issued*

The Controller of Civil Aviation reports as follows upon the number of certificates and licenses applied for and issued in respect to air personnel, aircraft and airharbours for the total period January 1 to December 31, 1920:

| *Type of Certificate or License Issued.* | *Applications Received.* | **Temporary Certificates Issued.* | *Permanent Certificates Issued.* |
|---|---|---|---|
| Private air pilot's certificate, | 60 | 1 | 53 |
| Commercial air pilot's certificate, | 142 | 9 | 78 |
| Air engineer's Certificates, | 111 | 19 | 65 |
| Air Navigator's Certificates, | 2 | nil. | nil. |
| Certificates of Registration of Aircraft, | 142 | 19 | 111. |
| Airharbour Licenses, | 47 | 21 | 16 |
| | 504 | 69 | 323. |

* Granted temporarily, pending issue of Permanent Certificates when the former automatically lapse.

### *Survey of Air Routes*

The Controller of Civil Aviation reports upon the following surveys of air routes which have been completed up to the end of December 1920, in all some 7,550 mi. of air routes having been covered:

(1). Airplane routes surveyed and flown over—Approximately 3,300 mi.

(*a*) *Winnipeg to Vancouver* via Brandon, Regina, Medicine Hat, Calgary, Revelstoke and Merritt.

(*b*) *Winnepeg to Edmonton* via Yorkton and Saskatoon.

(*c*) *Edmonton to Calgary.*

(*d*) *Ottawa to Camp Borden, Ont.* via Kingston.

(*e*) *Edmonton to Dawson, Yukon* via Jasper, Prince George, Hazelton, Wrangell and Whitehorse. This was surveyed in cooperation with representative of the U. S. Army Air Service, preparatory to New York to Nome flight.

(2) Seaplane routes surveyed and flown over—Approximately 2,350 mi.

(*a*) *Halifax to Winnipeg* via St. John, Fredericton, Riviere du Loup, Quebec, Montreal, Ottawa, Sault Ste. Marie, Port Arthur and Kenora.

(*b*) *Riviere du Loup to Lake St. John, Quebec* via the Saguenay River.

(*c*) *Ottawa to Lake Timiskaming, Ont.* via Ottawa River.

(*d*) *Ottawa to Lake Simcoe* via Muskoka Lakes and Ottawa River.

(3) Preliminary surveys of air routes—Approximately 1700 mi.

(*a*) *Vancouver to Lethbridge, Alb.* via Rossland, Granbrook, and Fernie.

(*b*) *Winnipeg to Sudbury, Ont.* via Sioux-Lookout and Hearst.

### *Prohibition of Dangerous Flying*

It has become evident to the Air Board after a survey of the 1920 season, that accidents have occured in the course of civil flying, due to machines being stunted with passengers at or even without their special request. As there is no purpose in stunting in civil flying, and since its prohibition would be beneficial not only for the purpose of preventing accidents, but also for the purpose of inducing a realization that flying does not involve or require the taking of risks, the Air Board has made the following amendment to Air Regulations, 1920, Par. 93:

(*a*). No pilot of any flying machine shall unless he is alone therein, or has the written permission of his passenger, permit or cause such flying machine to spin, roll, loop or execute any other evolution involving unnecessary risk.

(*b*). It shall be a defence to any prosecution under section 4, sub-section 2 of the Air Board Act for a breach of the foregoing regulation if the pilot establishes that his dangerous evolution was performed without intention on his part and notwithstanding the exercise by him of reasonable care.

### *Application of Air Regulations*

In response to a request from the United States Department of State, the Air Board has extended for a further period of six months, (from Nov. 1, 1920, to May 1, 1921) the time during which certain classes of United States pilots and aircraft may be permitted to enter and fly in Canadian territory, pending the organization of a body in the United States having authority to issue civil aviation certificates and licenses in accordance with the International Air Convention. This permission is granted, however, subject to the same provisions as were previously in effect, namely:

(*a*). Only qualified American military or naval pilots will be excepted from the provisions of Paragraph 33 of the Air Regulations, 1920, and then only in so far as is necessary to put them in the same position with regard to flying in Canada, as if they were the holders of certificates from the government of the United States, in accordance with the International Air Convention, that is, in the position of being entitled to fly United States aircraft in Canada, but not to carry passengers or goods for hire.

(*b*). Only American aircraft which would, under the Convention relating to International Air Navigation, be registerable in the United States of America, will be excepted from the provisions of Paragraph 3, of the Air Regulations, 1920, provided that:

(*1*). Full particulars of the aircraft are furnished.

(*2*). The aircraft is marked in accordance with the regulations with a nationality and registration mark of which the first letter is the letter "N" and the second letter is the letter "C".

(3) If such aircraft is one which under the regulations would require a certificate of air worthiness, a temporary certificate of air worthiness is issued.

(4) In all cases the same fees are paid as in the case of Canadian aircraft.

The question of granting special exemption from certain provisions of the Air Regulations 1920 in favor of E. Hubbard, a United States citizen, who has been given a contract by the United States Government for the carriage of mail by air between Seattle, Wash., and Victoria, B. C., has been under consideration by the Air Board.

Mr. Hubbard is not a United States military or naval pilot, and is therefore not entitled to the general exemption granted to American pilots of this class. Under the circumstances, however, and provided that on examination Mr. Hubbard is found to be a competent pilot and his machines airworthy, the Air Board has decided to grant him special permission to enter Canada under the regulations, as if he were a qualified military or naval pilot of United States nationality.

### *Examinations for Commercial Aviation Certificates*

It is of interest to announce that arrangements have now been made whereby officers and airmen of the Canadian Air Force taking their regular course of training at Camp Borden, Ont., may if they so desire, take at the same time the qualifying examinations and tests required for commercial aviation certificates, such as commercial pilots certificates, and air engineers certificates.

It is felt that such facilities will prove of great advantage to many individuals who may be desirous of engaging in commercial aviation, but who, without the facilities now provided for at Camp Borden, would find it difficult to pass the necessary examinations and tests, as laid down under the regulations.

### *Construction Work at Halifax Air Station*

It has been decided to maintain this station as a permanent erection and maintenance base. Plans for new construction work have been placed in hand in order to equip this station with two permanent hangars and a small workshop, together with adequate quarters for the staff. It is hoped that this construction work may be completed and ready for use during the flying season of 1921.

### *Central Air Board Depot*

The provision of a much needed central Air Board depot, has recently been under careful consideration. This depot would comprise the main engineering workshops, including the

aircraft repair depot and the engine repair depot; the central stores depot; and experimental flying station. The present depot at Camp Borden is inconvenient owing to its poor communications and distance from a large centre of population.

It has been decided that even though no immediate expenditure on a large scale can be undertaken for this project, proposals should nevertheless be formulated at once and plans definitely laid, with a view to the establishment of such a depot at the earliest opportunity.

### *New Types of Machines for Civil Government Operations*

The necessity for the purchase of more modern types of machines, in particular those designed specifically for commercial flying, for employment in civil government operations, in order to effect the adequate extension of these operations as may be required and to insure their more efficient conduct, has received the careful consideration of the Air Board for sometime. The machines now in use for this work are of obsolescent types and have already seen much service.

To meet this situation the Air Board issued, under date of August 11, a memorandum with specifications calling for tenders for a number of new types of machines from the leading aircraft constructors in Canada, Great Britain, and the United States. A number of tenders were received and after careful consideration it has been decided to recommend the purchase of six machines of four different types, all of the latest design, which it is considered will be suitable for Canadian conditions.

### *Grants for Aeronautical Research Work*

The following grants, amounting to $4,500, have been made by the Air Board up to the end of the year 1920, for aeronautical research work, which is being conducted under the Associate Air Research Committee of the Honorary Advisory Council for Scientific and Industrial Research:

(1) To Stanley Smith of Edmonton, Alberta, $500, for work in connection with his experiments on the improvement of barograph diaphragms.

(2) To Professor Angus, University of Toronto, $3,000, for the investigation of carburetor operation at low temperatures.

(3) To Professor Robb, University of Alberta, $1,000, for the investigation of the operation of water-cooled engines in low temperatures. In addition one aero engine complete with propeller and other accessory gear, has been issued to Professor Robb free of charge.

(4) To Professor McKergo of McGill University, $200, for work to be carried out on anti-freeze mixtures.

Arrangements have also been made for the carrying out of experimental work required by the Technical Branch by J. R. Parkin, in the wind tunnel at the University of Toronto.

### *Commercial Training*

The problem of providing adequate facilities for giving expert instruction in air navigation for those who may desire to qualify for commercial air navigators certificates, has again been under careful consideration by the Air Board. At the present time there appear to be no facilities for persons to undergo the necessary course of training in air navigation, in order to qualify them to pass the required examinations and tests. It is hoped, however, that arrangements may be made to overcome this difficulty at an early date.

### *Defence Committee*

The joint Military and Naval Committee has recently been re-organized and is now known as the Defence Committee. The Air Board is represented on this committee by the Inspector General of the Canadian Air Force, who is one of the four co-equal members. The other members of the committee represent respectively the Department of Militia and Defence, Department of Naval Service and the Royal Canadian Mounted Police.

In order to avoid wasted effort and the uneconomical expenditure of public money, it has been decided to make provision, where necessary, for the extension of the period of training in the case of officers and men attending Camp Borden who may require a longer period of training in order to qualify in accordance with the standard maintained.

According to this provision: "An officer or airmen who, at the end of his first short course of training in any rank, is not qualified for such rank, but who is reported as likely to become so qualified if he, being an officer continues under training for an additional four weeks or, being an airman so continues for an additional four or eight weeks and who is willing to so continue, will be retained on duty for training accordingly."

### *Civil Aviation in Canada During 1920*

Below is an extract from the statistical summary of civil aviation in Canada during 1920, showing the number of aviation companies, miles flown, passengers and freight carried, number of accidents and fatalities, together with the percentage of accidents and deaths to the number of flights made, miles flown, passengers carried, etc.

It is gratifying to note, from a review of these statistics, the comparative freedom from accidents and fatalities in proportion to the very large number of flights made, miles flown, and passengers carried, etc. The record is one which it is believed will compare favourably with civilian aviation statistics in Great Britain and the continent.

EXTRACT FROM STATISTICAL SUMMARY OF CIVIL AVIATION IN CANADA, 1920.

| | |
|---|---|
| Number of firms engaged chiefly in manufacturing aircraft | nil |
| Number of firms engaged chiefly in jobbing aircraft | 2 |
| Number of firms engaged chiefly in operating aircraft | 30 |
| Number of firms employing aircraft as auxiliary service | 3 |
| Number of machine-flights made, | 18671 |
| Number of machine-hours flown, | 6505 |
| Approximate machine mileage, | 422462 |
| Average duration of each flight in minutes, | 21 |
| Number of passengers carried, | 15265 |
| Approximate passenger-hours flown, | 5164 |
| Total freight carried in lb., | 6740 |
| Number of accidents resulting in death to one or more occupants of machine | 5 |
| Number of non-fatal accidents resulting in injury to occupants of machine | 4 |
| Number of accidents resulting in death of third party (occupants of machine uninjured) | nil |
| Number of accidents in which no one was killed or injured | 5 |
| TOTAL ACCIDENTS REPORTED | 14 |
| Approximate number of machine miles per accident, | 30176 |
| " " " " flights " " | 1334 |
| " " " " hours " " | 465 |
| LICENSED AIRHARBOURS | |
| Public aerodromes, | 7 |
| Public seaplane stations, | ..... |
| Private commercial aerodromes, | 23 |
| Private commercial seaplane stations, | 6 |
| Licensed also as customs airharbours, | 4 |
| Total all types, | 36 |
| LICENSED COMMERCIAL AIRCRAFT | |
| Airplanes, | 58 |
| Float seaplanes, | 4 |
| Boat seaplanes, | 8 |
| Single engined type, | 70 |
| Twin " " | ..... |
| Multi " " | ..... |
| Total all types, | 70 |
| LICENSED COMMERCIAL AIR PERSONNEL | |
| Pilots, | 71 |
| Air engineers, | 60 |
| Air navigators, | ..... |
| Approximate number of air mechanics employed, | ..... |

## The Air Service Border Patrol

Out along the Rio Grande where it cuts its way through barren mountain ranges and runs in deep canyons, where nothing but rocks and sand greet the eye for miles and man seldom sets his feet, the "Border Patrol" watches over the vast and lonely territory of the Border Line, to prevent any infringement upon the laws of the United States.

The patrol is composed of officers of the Air Service who fly along the border twice a week watching the international boundary for hostile bandits, the wary bootlegger or the wily ammunition runner. Over the unending mass of rocks and steep mountain sides the aviator sails, knowing that if ever his motor fails or his fuel runs out, somewhere on the sharp rocks below he must pilot the plane, only to go crashing into canyon or mountain side. The Air Service has every reason to be proud of these intrepid airmen.

## Landing Field Notes

The movement in favor of more landing fields is progressing throughout the country, as may be seen from the following information which was condensed from newspaper reports.

At Wheeling, W. Va., the Rotarians recently discussed the feasibility of establishing a landing field for military and commercial airplanes. Capt. Temple Joyce, of the Maryland Aviation Commission, some time ago made a flight for the purpose of locating a desirable site that would serve as an air station for Baltimore, Md.

At Muskogee, Okla., a site for a commercial landing field has been obtained by J. B. Witt, aviator, and M. H. Wood, where hangars, machine shops and gas and oil depots will be erected.

According to the Seattle, Wash., *Times*, the municipal air port of that city, Sand Point, is to be taken over by the Navy, which intends to spend about $1,000,000 for reconditioning the field into a naval air station.

New Orleans is soon to have a commercial seaplane station, permission having been given to the Gulf Aerial Transportation Co. by the Dock Board of that city to erect a hangar on the river bank at the foot of Carrolton Avenue. The company proposes to run a seaplane service for passengers between New Orleans and Pilot Town, La. It is expected most of the passenger traffic will be persons who want to make hurried trips to the city from ships arriving at Pilot Town, while persons who miss their ships at the wharf at New Orleans will be carried to them.

At Franklin, Pa., the Globe Aerial Transportation Co. has leased a tract of 28 acres on Gurney Hill, which is to be used as a landing field.

At Porterville, Cal., through the efforts of the American Legion post, an option has been secured for a landing field. A tract of land on the Olive street highway has been chosen for the site.

St. Joseph, Mo., intends to establish an aviation field, from sixty to eighty acres in area, south of Lake Contrary. The project is being investigated by the aviation committee of the Commerce Club of St. Joseph.

Lt. Robert Blair, formerly test pilot at McCook Field, Dayton, Ohio, has established a commercial flying field at Little Rock, Ark., for passenger carrying business. The field adjoins the Aviation General Supply Depot of the Air Service. It was formerly a cotton patch and required a considerable amount of clearing and grading, but it is now reported to be in excellent condition.

At Burlington, Ia., aviation enthusiasts and automobile dealers are fostering a movement to have the town establish a permanent landing field. A local firm, Hartman and Cellar, already have an airplane at Burlington and intend to expand their business in the spring.

## Aircraft Underwriters Seek Data

A short time ago an appeal was made by the National Aircraft Underwriters Association to aviators for information regarding the characteristics of the ground along air routes that the individual pilots had actually flown. So far only one or two reports have been received and at this period there are sadly lacking data relative to the condition of the land, from a "cross-country" pilot's point of view, concerning the following States: Arizona, Delaware, Idaho, Kentucky, Maryland, Montana, Nevada, Oregon, Tennessee, Utah, Vermont, West Virginia.

As some pilots may not have noticed the article AVIATION printed on this subject, the Association reiterates its request to all pilots (thanking those who have already been kind enough to co-operate) to sit down and write as fully and as generally as possible, a report on one of the above mentioned States, taking the one that they are most familiar with.

All reports should be addressed to R. J. Smith, Asst. Sec'y., National Aircraft Underwriters Association, 132 Nassau Street, New York City.

In answering, please quote:

What route are you describing?

Is the ground rocky and dangerous to land on along this route?

Is it swampy or marshy, or cut up in any way that would affect a safe landing?

Is it woody or hilly?

Are there many large fields in which a plane could land safely?

What is the average size of the fields along the route described, wherein a plane could make a safe landing?

What are the names of the principal aerodromes along the route?

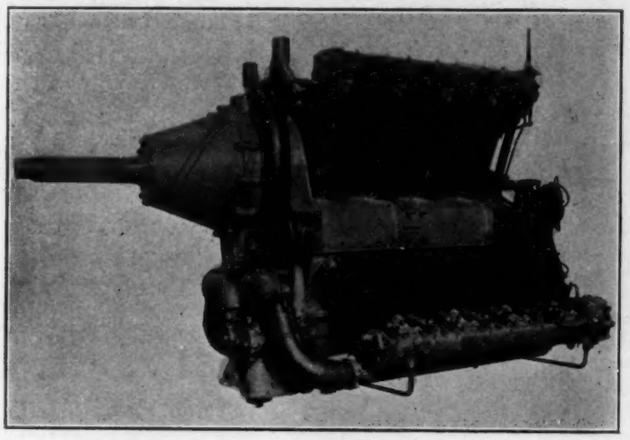
How many and where are the depots from which supplies (spare parts, gas, oil, etc.) can be obtained?

In your opinion, which are the most dangerous spots along the route, and would a cross-country pilot have any difficulty in finding a safe place to land, or are there good landing fields all along the route?

With this data on hand, the Association shall be able to provide, to any pilot who cares to write for it, a long needed requirement, that is, a pilot's opinion of different territories.

## The Napier "Cub" 1,000 Hp. Engine

D. Napier and Son, Ltd., the designers and manufacturers of the well known Napier "Lion" 450 hp. engine, have just completed the construction of a 1,000 hp. engine, called the "Cub". On the first bench tests, which are reported to have given very satisfactory results, the engine developed 1,057 b.hp. The new engine is built on an entirely new principle, being comprised of four rows of four cylinders set in X shape, not absolutely diagonally opposed, but with two top sets of cylinders at a smaller angle than the lower sets. The engine is illustrated herewith.



THE NAPIER "CUB" 1,000 HP. AIRPLANE ENGINE

## Rio de Janeiro to Buenos Aires

A remarkable long distance flight was recently made by a Brazilian aviator, Edu Chaves, on a Curtiss Oriole K-6, when he flew from Rio de Janeiro, Brazil, to Buenos Aires, Argentine Republic, in less than five days.

There have been several attempts in the past to link the two great capitals of Latin America, but they all had ended in failure. Sr. Chaves flight is the more remarkable as he covered the total distance of 1,735 miles with clocklike regularity, which may be seen from the appended timetable.

| STAGES | DATE DEPARTURES | | | ARRIVALS | | TIME | | MILES |
|---|---|---|---|---|---|---|---|---|
| | Dec. | hr. | min. | hr. | min. | hr. | min. | |
| S. Paulo-Rio | 24 | 15 | 3 | 18 | | 2 | 57 | 250 |
| Rio.-S. Paulo | 25 | 5 | 45 | 8 | 15 | 2 | 30 | 250 |
| S. Paulo-Guarantuba | 26 | 12 | 12 | 14 | 50 | 2 | 38 | 280 |
| Guaratuba-P. Alegre | 27 | 10 | 45 | 15 | 20 | 4 | 35 | 370 |
| P. Alegre-Montevideo | 28 | 9 | 45 | 14 | 35 | 5 | 50 | 450 |
| Montevideo-Buenos Aires | 29 | 11 | 10 | 13 | | 1 | 50 | 135 |
| Totals | | | | | | 20 | 20 | 1,735 |

## Opening Exercises of America's First Airway

The inauguration exercises in connection with the preparation of the model American Airway which is to extend from Washington, D. C., to Dayton, Ohio, via Moundsville, West Virginia, and Columbus, Ohio, took place at Bolling Field, Anacostia, D. C., on Feb. 12, 1921.

There were approximately one thousand Boy Scouts there. The Boy Scout organization is to assist the U. S. Army Air Service in the preparation of this route by clearing the landing fields selected and establishing proper identification markers on them. There were a number of very distinguished people present, prominent among them were Brig. Gen. William Mitchell, Mr. Huston Thompson, Mr. Isaac Gans, Mr. Edward D. Shaw, Mr. A. G. Batchelder and others.

THE FIRST LINK IN THE AMERICAN MODEL AIRWAY; DC 1, THE MARKER FOR WASHINGTON, D. C.
*Photo U. S. Army Air Service*

After the huge marker "D.C. 1" had been laid and whitewashed by the Boy Scouts a talk on what air transportation means now and in the future and how the airways of the United States serve the airplane just as the road ways serve the automobile was given by Brig. Gen. William Mitchell. At this occasion the new Army Air Service "Messenger" airplane made its first public appearance being flown in from New York by Lawrence Sperry of the Lawrence Sperry Aircraft Co. in a little under three hours despite poor flying weather. Also the Morane Saulnier monoplane known as the Morane Parasol was flown in from Baltimore, Md., where this type of plane is about to be put in production, by Captain Temple N. Joyce carrying with him one of the scout leaders of Baltimore.

Later Mrs. Williams, wife of the Assistant Secretary of War, took a long flight in the Morane piloted by Capt. W. C. Ocker. Demonstration flights were given by many of the pilots at Bolling Field flying S.E. 5's which were followed by demonstration flights of both the Messenger and the Morane Parasol. Both exhibited unique ability in quickly getting off the ground and in landing in a small area, besides their remarkable flying performance. These two planes undoubtedly exhibit characteristics essential to the first purely commercial type of airplane that will come into common use within the next few years. Toward the end of the ceremony General Mitchell was presented with a copy of one of the first air route map made by the Rand McNally Co. through their representatives Mr. Newmaker and Mr. Tufts. This ceremony was eminently successful in spite of rather disagreeable weather conditions and the proper inauguration of this immense work which will be formally dedicated early in March thereby creating the first physical airway in the United States which will serve as a model for the expansion of hundreds of other airways throughout the United States.

## Summer Camp for R.O.T.C. Students

Authority has been requested of the Adjutant General by the Chief of Air Service to have all students in the R.O.T.C. units, who are taking the advanced work and have signified preference for the Air Service in their training, attend the summer camp which will be held at Post Field, Fort Sill, Oklahoma. It is believed that there are about ten such students at the Massachusetts Institute of Technology and approximately a similar number at other institutions where this work is being carried on.

This camp will begin in the early part of the summer of 1921, if authorized, and will include training for observers for a period of about six weeks. The advanced course in the R.O.T.C. units is open to qualified members of the junior and senior classes and the Air Service course comes within this advanced training. After the men attend this six weeks' camp, after their junior year, upon graduation they agree to accept and receive a commission as second lieutenant in the Air Service. At the time of their graduation they receive their commission as second lieutenant and proceed to a flying school for training as airplane pilots. The commission as second lieutenant, Air Service is given in the Reserve but on active status, but at the end of six months service the student is permitted to select whether his commission will remain as active or inactive and makes request accordingly.

## A New Pioneer

C. P. Mayer of Bridgeville, Pa., has developed a plan of building airplanes which ought to stimulate the sportsmen of the country to build "custom made" aircraft. He has engaged Alexander Klemin and Associates to design an airplane for his family use, one which can be used for touring and have the maximum degree of comfort and safety. After the designs have been approved he will have the airplanes built by American constructors in the same way that yachtmen have their pleasure crafts built at ship yards.

Mr. Mayer has been interested in aviation since last October by reason of having two aviation fields; one of these, called Field No. 1, has a hangar which holds five airplanes. The second and larger field, which is now being cleared of trees, wires, buildings, etc., will be equipped with repair shops and large hangars. Contracts for the shops are already let and the field is to be ready for service in the spring.

The activites of Mr. Mayer have given him the reputation of a man of wide business experience. He is in the lumber and builders' supply retailing business, paving brick manufacturing service, coal stripping operation and under-ground coal operation. He controls the South Hills Publishing Co., which is an extensive printing establishment and which also publishes the South Hills News. He is president and general manager of the Inter-State Gasoline and Oil Co., which operates in West Virginia, and is director and dominating influence of the First National Bank of Bridgeville, Pa. At the present time, he has under control a gasoline distributing station in connection with the aviation field so as to obtain uniform gasoline from his own factory.

## A New German Aviation Company

An aviation company recently has been organized at Dantzic with a subscribed capital of two million marks under the title of the Internationale Luftschiffahrtsgesellschaft Ileg. The company takes over the existing premises at Dantzic used by the German military authorities during the war as an airplane factory and intends to build suitable flying machines for the new air services. It is said that sufficient aviation material is already available for the construction of at least thirty airplanes. The founders of the new venture are, a factory proprietor named Lilienthal, who is connected with the Albatrosgesellschaft, and a Dr. Donski, an engineer. The new company claims to have secured a contract from the Polish Government for the conveyance of air mails between Dantzic-Warsaw-Cracow and regular services between Dantzic-Posen-Cracow have already been decided upon. Mails between Dantzic and Warsaw by the ordinary methods of transport take several days as compared with three hours by the airplane service now instituted.

IN the newer developments in flying—in the new successes of craft and motive power Wright Aeronautical Engines have conspicuously proved their merit.

It is proverbial then that Wright design and Wright performance would contribute in ever increasing measure to the commercial phase that is fast overtaking aeronautics in America.

WRIGHT AERONAUTICAL CORPORATION
PATERSON, N. J.

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*Wright Aeronautical Engine Model E-2, 180 H. P.*

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4. PROPERTY DAMAGE (Damage to the property of others).

SPECIAL HAZARDS

*Windstorm, Cyclone, Tornado—Passenger Carrying Permit—Stranding and Sinking Clause—Demonstration Permit—Instruction Permit*

AGENTS IN CITIES, TOWNS AND VILLAGES THROUGHOUT THE UNITED STATES AND ITS POSSESSIONS, AND IN CANADA, MEXICO, CUBA, PORTO RICO AND CENTRAL AMERICA

*Aircraft, Automobile, Fire and Lightning, Explosion, Hail, Marine (Inland and Ocean), Parcel Post, Profits and Commissions, Registered Mail, Rents, Rental Values, Riot and Civil Commotion, Sprinkler Leakage, Tourists' Baggage, Use and Occupancy, Windstorm*

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## AIRCRAFT YEAR BOOK

1921

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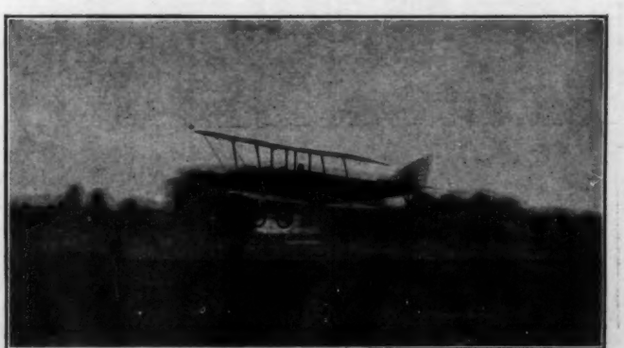

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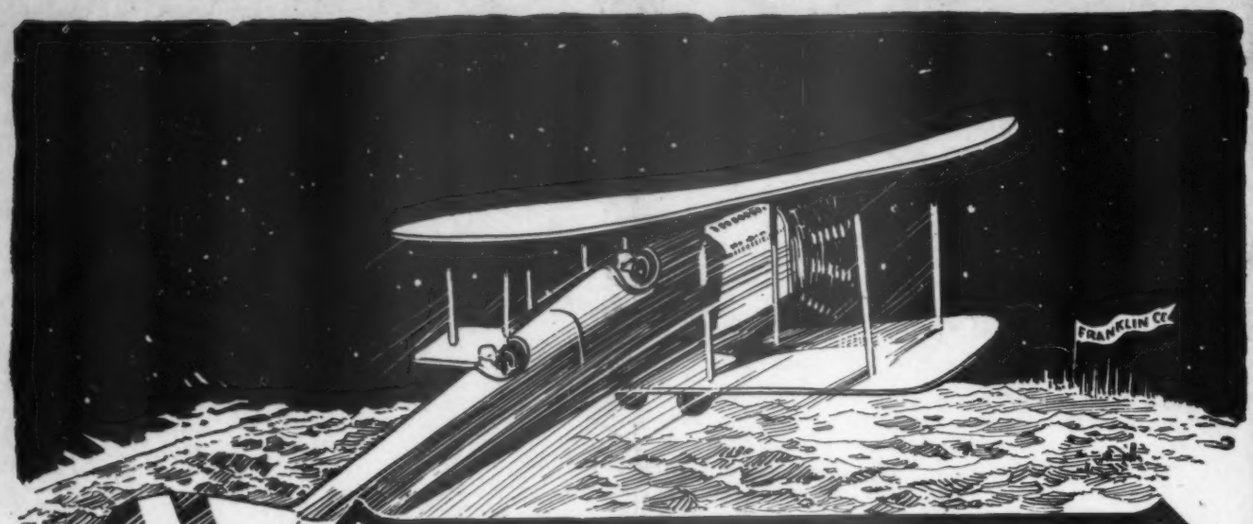


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